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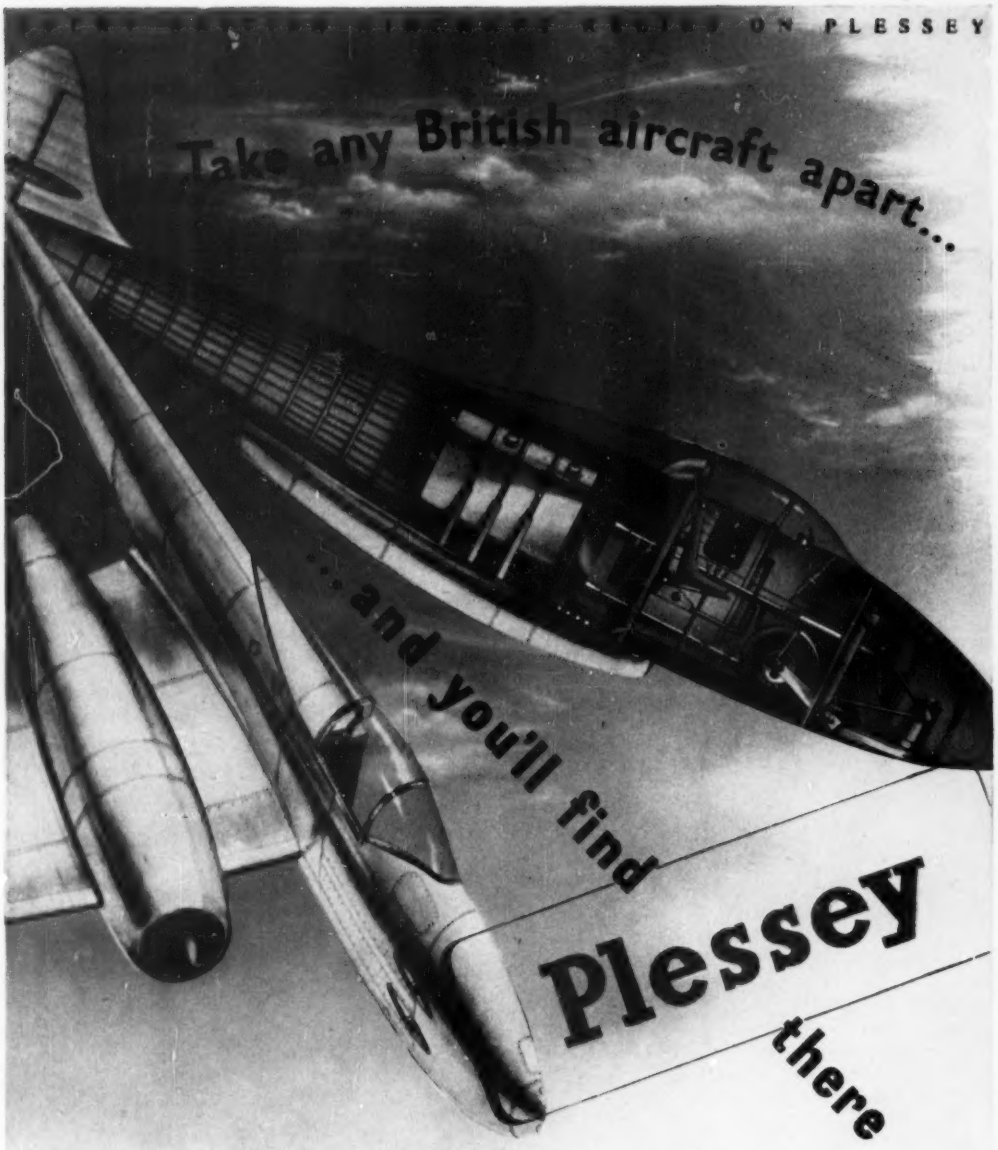

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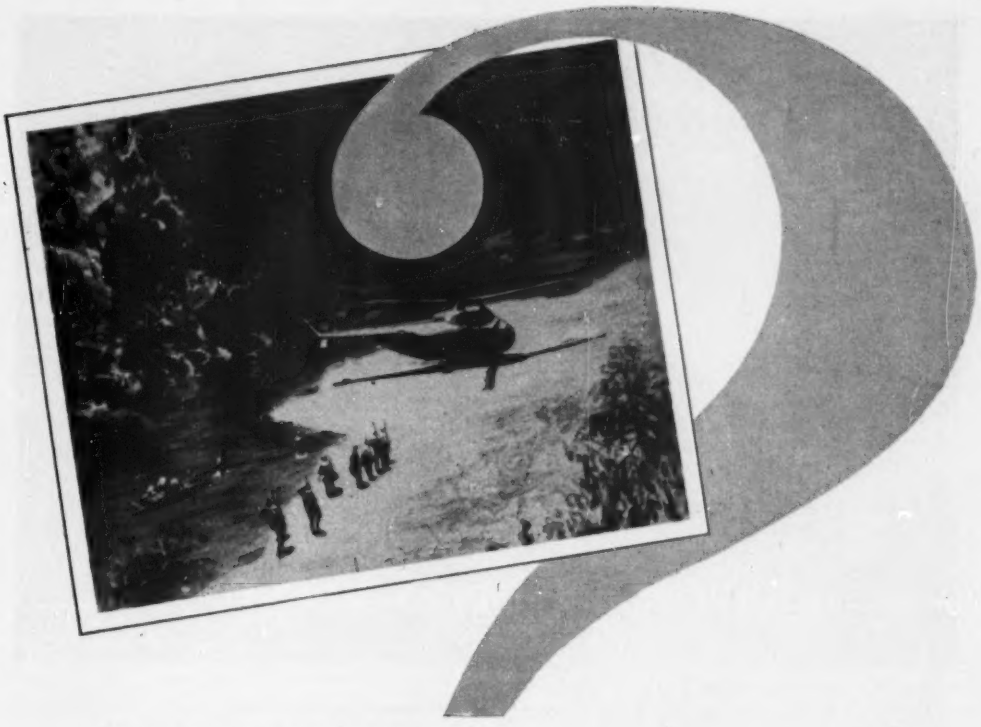

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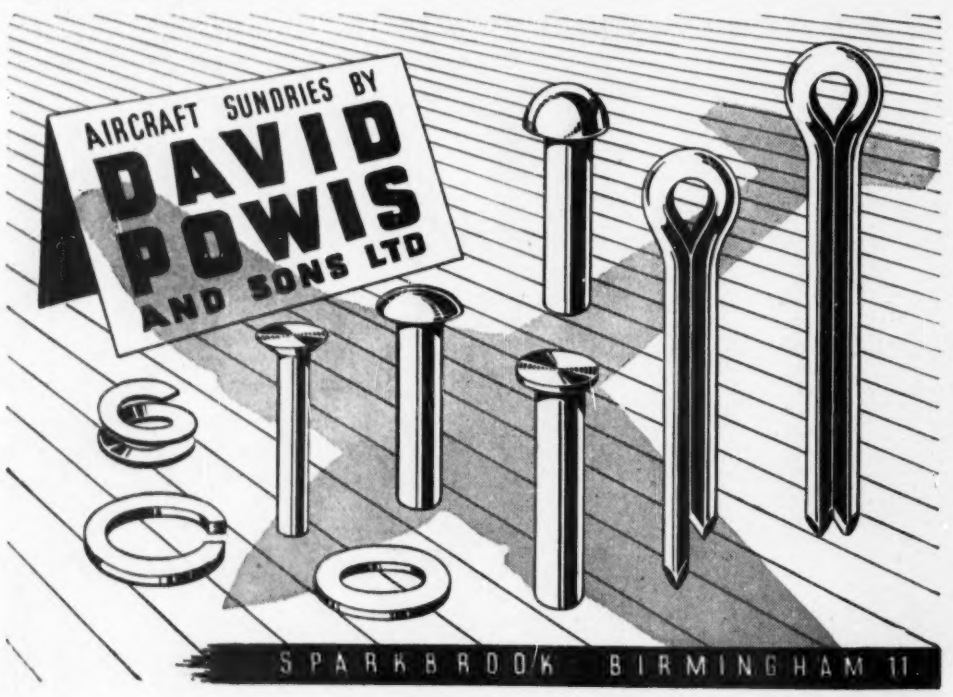

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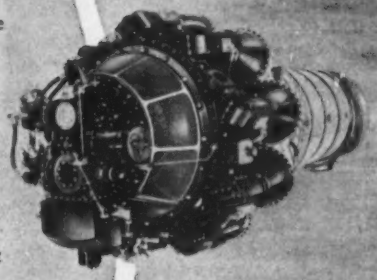

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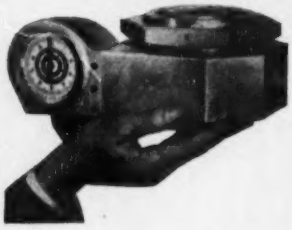

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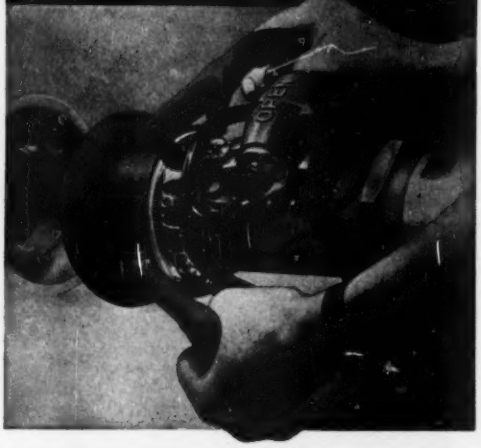

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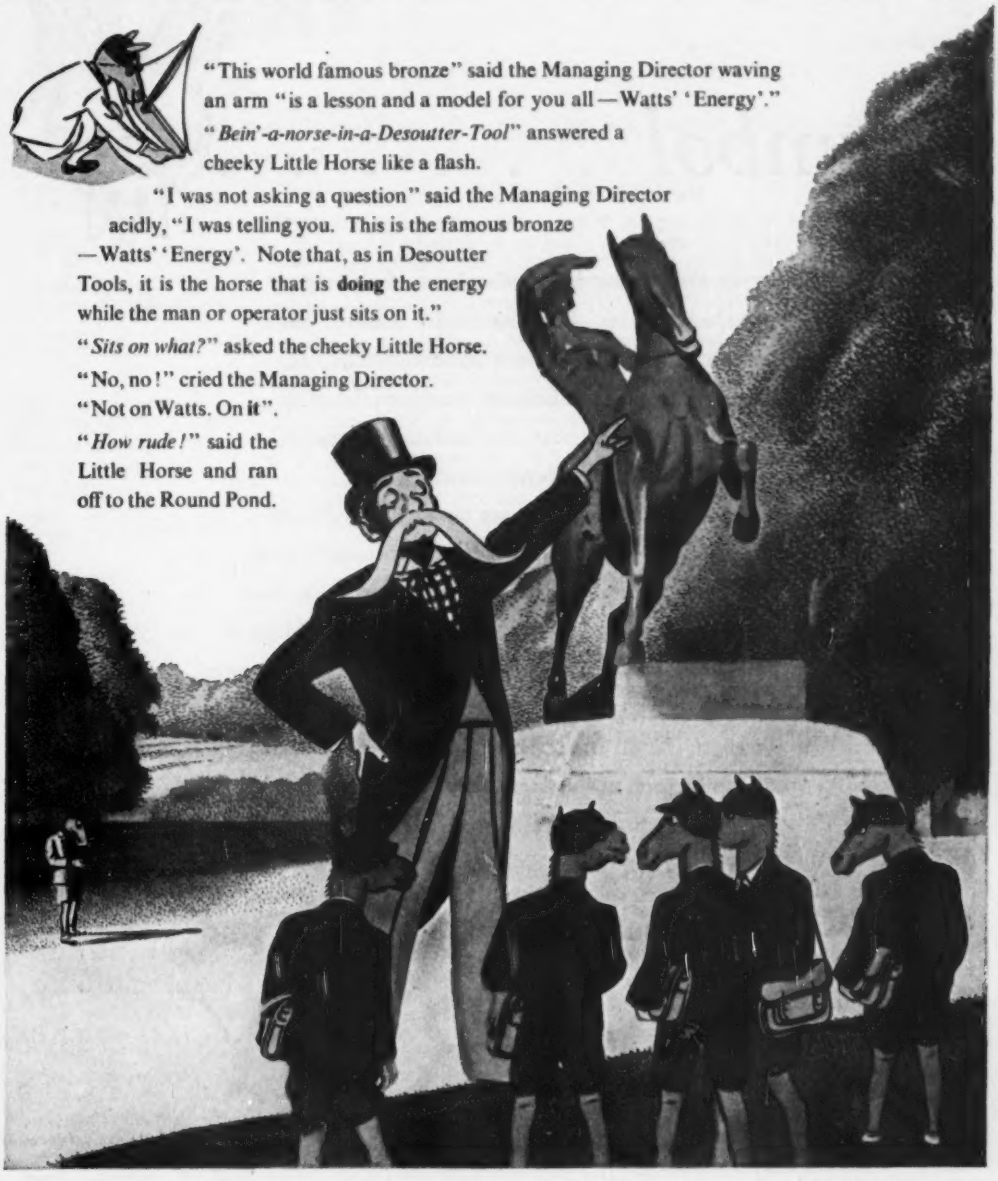
"*Sits on what?*" asked the cheeky Little Horse.

"No, no!" cried the Managing Director. "Not on Watts. On **it**".

"*How rude!*" said the Little Horse and ran off to the Round Pond.



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Balanced View

THE aims which the British aircraft industry should be helped to pursue have been the subject of recent public discussion, and seldom can greater unanimity of opinion have been shown. We make no apology for reiterating in this issue the views expressed by leaders in the political, industrial and military spheres—men whose responsibility it is to steer this country back to financial stability and thus to its former position of strength and respect. Our re-statement of several of these views, overleaf, is followed by a particularly pertinent and outspoken article by a contributor known personally throughout the industry and, as a broadcaster, to a wide public. He enlarges upon some of the points advanced in our editorial of December 28th, and his views imply a direct challenge to the present allegedly "all out" policy on aircraft production; and if the Government and industry feel unable to accept it, then we hope and expect to learn why.

At the beginning of this new year a lead is eagerly sought: a driving force that will enable the aircraft industry, in addition to meeting its obligations to the fighting Services, to seize the commercial opportunities now clearly revealed. That there will be difficulties and setbacks cannot be doubted, but it is our impression that the people as a whole are in a mood to face such things—provided that, as a result, they can see the possibility of putting an end to the embarrassments and humiliations of recent years. So many appeals to the nation have lacked the constructive approach which would have given inspiration; it was becoming increasingly difficult to give a wholehearted response to yet more calls to patch up this or that crumbling structure.

But in the case of the aircraft industry it is different, for here we have something sound to build upon; by the sale of its excellent products it is capable on its own of making a substantial and lasting contribution to the nation's economy, the beneficial results of which will ultimately be shared by all. Moreover, by increasing the strength and productive capacity of this vital industry on a permanent basis, the country will be in a better position to meet any threat to world peace or its own independence.

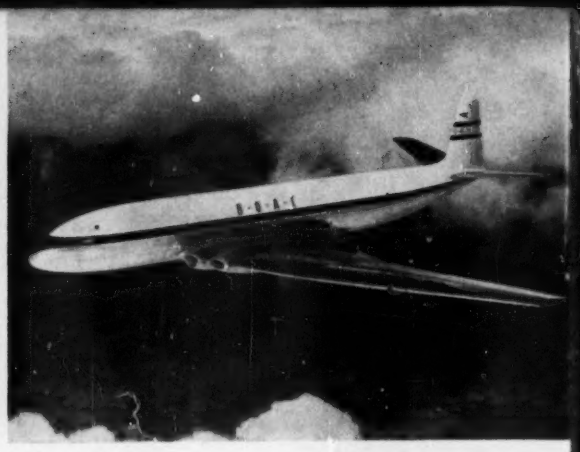
An Expensive Game of Bridge

AFTER the pilot who flew a light aircraft through Tower Bridge had been fined £100 (see page 18) one or two people remarked to us that they considered the penalty unnecessarily severe; they thought that something comparable with the price of a speed-limit offence—say £5—would have met the case.

Without wishing to adopt a "holier than thou" attitude—for at one time or another most of us have known that sudden impulse to depart from the straight-and-level path of aeronautical rectitude—*Flight* must go on record as being disinclined to echo such commiserations. Setting aside the question of whether £100 is, in fact, a heavy fine (for the true severity of a monetary penalty can be measured only against the depth of the wrongdoer's purse), an offence of this kind is hardly comparable with the average motoring misdemeanour. That road and river traffic were light, the weather fair and the aircraft reliable, as pleaded by the defendant in mitigation, is surely beside the point. Flying through a bridge in a "populous area" must automatically involve a breach of the law against low flying, and it was under this section of the Air Navigation Act that the Taylorcraft pilot was charged. These regulations were formulated on the advice of experts who may be assumed to be sound judges of what constitutes reasonable safety minima at all times; and, since no one would seriously suggest that the rules be made sufficiently flexible to adapt themselves to times, traffic, weather and whatnot, it is clearly up to pilots, whether of Austers or of Brabazons, to abide by them.

However proficient the pilot, however airworthy his machine, the fact remains that engine failures can occur, and very occasionally do occur; and one quite small aeroplane with a few gallons of petrol on board can cause a highly unpleasant and spectacular incident in a built-up area. Even if the only victims are the crew, the resultant publicity (and there will be plenty) inevitably harms the aviation movement as a whole.

Hawker P.1067.



de Havilland Comet.

SWORDS *and* PLOUGHSHARES

Why not both at once? Building for sure defence and a sound economy

AN opportunity of a kind unlikely ever to present itself again—that of capitalizing in the world's markets our lead in gas-turbine-powered transports—is now open to the British aircraft industry. Do current rearmament commitments really present an insurmountable bar to our seizing the chance? The question has lately been asked, in one form or another, by several men prominent in Service and civil affairs, and in this article we briefly recall references they have made to the subject. Following it we print a forthright challenge to the industry, made by W/C. Charles Gardner, well known both at Home and abroad as the aviation correspondent of the British Broadcasting Corporation. He recognizes that the greatest problem is that of manpower; and he makes a suggestion for its solution. His remedy may seem drastic, but he goes on to show that it would be justified by the ultimate prize.

AIR CHIEF MARSHAL SIR GUY GARROD and the Air League of the British Empire, of which he is chairman, can take pride in having touched off what amounts to a campaign that may prove of vital importance to the country. At a luncheon in London on November 1st, in drawing attention to the serious weakness of Britain's military air potential, he emphasized that the cure was basically a matter of manpower and the development of the aircraft industry. He went on to say that in turbojet and turboprop aircraft this country had a lead of at least five years over the rest of the world, and that therefore we ought to be producing such machines in considerable numbers. We needed them as part of our military equipment and, at the same time, they would be most valuable exports, not least in securing a permanent position in the world market for many years to come. Yet we were in danger now of repeating the disastrous decision made during the last war—of leaving the building of transport aircraft to the Americans. Foreign airline operators fully appreciated the potentialities of the new gas-turbine aircraft, but could not be expected to order them unless they could be certain of delivery. But by expanding our output of transport aircraft we could, at one and the same time, create an actual and potential export trade and also make an indispensable addition to our air power resources.

Mr. Churchill touched on similar matters in the House a few weeks ago. In discussing a rearmament programme which involves the expenditure of £1,250 million in the present year—a sum which, he said, we should not in fact succeed in spending—he gave the assurance: "It is perfectly clear that, in the sphere of the material things, the claims of the R.A.F. must have first and special emphasis in priority." Then he went on to say: "This will be made fully effective in any rearrangement of the programme upon which the new Government might decide. . . . The greatest source of concern in the Services is the slow progress in developing the R.A.F., especially in the supply of the latest machines. . . . To read the complaints that are made about the disappointments experienced in equipment, one would hardly believe that over 300 million pounds was being spent this year."

There can be few intelligent people today who have failed to recognize the need for expansion of the aircraft industry for military production, and there must be many who have felt as Mr. Attlee does. He said during the course of the same debate, "no one knows better than the Prime Minister how heart-breaking are the delays in the production of aircraft. They are called 'teething troubles.' One gets an aircraft and one thinks it is going ahead; trials are made and one thinks one is going to have delivery; but, in my experience, not only over the last six years, but in the five years before that, there are always delays."

But in spite of the concern which so many people have felt and expressed regarding the slow production of new military aircraft, there has emerged, during the last weeks of 1951, a general realization that the well-being not only of the aircraft industry, but of the nation itself, may depend on the balancing of the production effort between aircraft essential for defence and others capable of earning vast sums in dollars and other currency. Ultimately we must provide for both.

Talking of British civil airliners, Lord Ogmore, Minister of Civil Aviation in the late Government, said recently in the House of Lords: "Here is a market for the asking. To make use of it, it will mean that aircraft manufacturers will have to have more materials and more men in order to fulfil both these orders, and the military orders to which they are committed. I am afraid that it will mean some sort of funnelling of materials and men from industries which are not so important."

To this, Lord Brabazon added that, "if the Secretary of State for Air will now acknowledge that air transportation is a military function of the Air Ministry, things will change a good deal."

Lord Balfour of Inchrye, in his turn, said the success of our long-term policy depended finally on the supply of aircraft, while Lord Gifford thought that today this country had "a unique opportunity in the field of civil and transport aircraft," which he suggested should be treated as part of our rearmament policy; he pressed for "a powerful, bold and progressive programme," because this was an opportunity which might not recur in years."

In the same debate, Lord Pakenham said that it would be a tragedy if, after having gone in front, we slipped behind again, and he asked whether Lord Selkirk would give con-

Vickers-Armstrongs Viscount

Vickers-Armstrongs Valiant.

sideration to the suggestions which had been made that the production of Comets and Viscounts and other such aircraft should be increased.

In his reply, Lord Selkirk said that Lord Ogmore's phrase "funnelling of labour" was important, because this was one of the great difficulties. It would be a matter of the greatest disappointment if, at this stage, when we had gone through so much, other pressure did not allow us to reap the benefits of what had been achieved.

What might be called military and long-term views on the same subject were expressed by the Vice-Chief of the Air Staff, Air Chief Marshal Sir Ralph Cochrane, in a recent speech at Bristol. He said, "we are approaching the age of air transport, and should be able to look forward confidently to the future were it not for the cleavage between east and west, which overshadows our whole way of life. In these circumstances, we are forced to concern ourselves first with the military developments of this new medium. The overall requirements for aircraft add up to a considerable bid on the available national resources. Yet I suggest that very careful thought will have to be given before deciding not to meet them."

Sir Ralph went on to say, "air power, if it is to be permanent, must be broad-based on commerce. We built up our sea power on ships, constructed in this country for owners all over the world as well as for our own trade, and this has had great influence on our life as a seafaring nation. The air must do the same, and I see no reason why it should not." This provided a wonderful opportunity for the boys who were now in schools and colleges in this country. "Let them realize," said the V.C.A.S., "that we are only at the beginning of the air age, that we are hardly scratching the surface of what will come to be done in our lifetime, and that a great new field of enterprise is becoming available in which they can share." He added, "in building up air power, our first thought must be for quality."

Of the aircraft industry he said, "we have got to build up immediately because we must rearm, but in the long-term because we seek to create a home and overseas trade comparable with our great shipping industry."

In conclusion, Sir Ralph said, "Let us then determine two things, firstly that the air over these islands shall never again be sullied by hostile aircraft. . . . and secondly, let us determine to develop the peaceful commerce of the air so that this country may take its place once more in the forefront of progress."

CHALLENGE

By CHARLES GARDNER

BRITAIN is in a bad way; Britain needs new industries; Britain needs new exports; Britain needs to sell more skill and to buy less raw material.

All this, and much more, has been dinned into us. All right, we believe it. We are also willing to believe that somewhere, there must be over-all planning to achieve it. Furthermore we believe that Britain cannot exist for much longer, this side of bankruptcy, on trying to sell nylons, lipsticks, fabrics and woollens and even motor cars, in an ever decreasing and ever more competitive world marketplace.

All of which, being true, makes a nonsense of what is happening today in our aviation industry.

Think, for a moment, of the attractions for us of the world market in airliners. For instance :—

(1) In gas-turbine transports we are the tops; even the Americans admit our "three to five year lead."
(2) Selling big airliners is for us a comparatively new market, with considerable possibilities of expansion.
(3) The finished product combines more skill with less raw material than does that of any other heavy industry—and it sells for big money.
(4) A steady civil export market would reverse the unhealthy position of an industry living on international and re-armament crises—and on other people's "nerves."

Yet all the indications are that if we are not careful we are going to throw over our great opportunity because, it is said, "we can't re-arm as well as build commercial aircraft."

Well, why can't we do both?

We don't question the need for re-armament—the necessity for the Valiants, 1067s, Swifts, Canberras, and the rest. That is self-evident. But, also self-evident are the market potentialities of the Comet, the Viscount, the Bristol 175—and, although it is piston-engined, the Ambassador.

At last year's S.B.A.C. Show, Mr. E. C. Bowyer said that our possible export trade in jet airliners, over the next ten years, could total a thousand million pounds sterling—which is £100 million a year.

What other British industry nets us £100 million of export a year? Here is the list :—

Motor vehicles (and chassis)	£178 million
Cotton	£158 "
Steel	£156 "
Wool	£140 "

To these must be added machinery of all kinds (including practically everything that drives or is driven)—£316 million.

Some industries which do *not* gross us £100 million are shipbuilding (£40 million), chemicals (£60 million) and silks (£50 million).

The civil airliner trade could, therefore, become one of our top five export industries; I repeat that—*one of our top five*.

Let us make a quick comparison with the motor industry. The ordinary car takes a ton of raw material (mainly steel,

CHALLENGE . . .

which is scarce). That ton, plus skill, nets us say, £500 of cash. The Comet takes 22 tons of raw materials (mainly aluminium, which is not scarce). Those 22 tons, plus skill, net us £500,000. The car industry, therefore, in its combination of steel and skill, is worth about £500 a ton. The Comet, in *its* combination of aluminium and skill, is worth £23,000 a ton.

No one says that we can't afford to build cars as well as tanks. But they *do* say we can't afford to build airliners as well as warplanes.

To my simple mind it would seem, mathematically, to be worth putting all the motor-industry manpower into producing airliners. By so doing, Britain would be "up" by £18,000 per ton of exported goods. Or is this too simple?

Let us, then, check our export assumptions, or rather Mr. Bowyer's export assumptions. He says we can do £100 millions of export business in jet airliners per year. There are, at present, in world fleets, about 1,000 big mainliners, and some 2,000 "Continental" aircraft of DC-3 size. Each world fleet, as a group, is worth about £500 million. Assuming that the mainline fleets are changed once in ten years, and the DC-3 types once in five years, there is a total of £150 million a year available in the airlines as it stands. This is allowing for no expansion in a business which is, in fact, going to expand enormously. With spares at 20 per cent the total present-day annual market is £180 million; allowing for some growth, let's call it £200 million.

If Britain could grab but half that market with her Comets, Viscounts, 175s, Apollos, and Ambassadors, then Mr. Bowyer's optimism is justified. And this is not counting any sales of Heron or Dove or similar-sized feederliners. In other words, the market *is* there; is not just a pipe-dream.

Up our Street

And please to remember about the civil jet airliner business, we *are* the world's best—and usually the world's best is not too hard to sell. We are *not*, however, the world's best at making nylons and lipstick and a thousand and one other fritterers-away of our manpower. Nor are we, with some individual exceptions, the world's best at making motor cars.

Again, to my simple mind, I should have thought we should have welcomed with eager arms an industry which offered rich new fields (with richer still to come); which made no excessive demands on scarce raw imports; which would easily become our biggest single "export"; in which we held a clear world lead of "three to five years"; and in which, also, skill and craftsmanship were considerable ingredients. By all our traditions, this is right up our street: is it not, indeed, just the thing we, as a nation, are alleged to be looking for?

The aircraft industry is well aware of all this, and its leaders could add many more details to the case I have just roughed out. They could tell, too, of customers who have asked for delivery dates . . . and then walked sadly away.

How maddening all this is after five years of enterprise, genius, courage, hard work, and the investment of some £140 millions of our national treasure—all to end in just a *succès d'estime!* We can rest miserably assured that such a chance will never come our way again—not after the C.A.A.'s recent report.

And we hardly need ask what is the root cause of this impending national disaster. It is lack of manpower—or rather, lack of properly distributed manpower.

The aircraft industry now employs some 170,000 people. To meet its re-armament programme it needs a further 150,000, and to cash in on the jet airliner market it needs a total of 420,000. In the final analysis, then, the lack of 250,000 men and women threatens to be our downfall; and only 100,000 of those are needed for the airliners with which we are concerned.

During the war two million people were employed in the aircraft industry. Less than one-quarter of that total would save us now, in a position which lies no less close to our ultimate national safety. And "skilled" labour is not, in the main, called for; as one leading manufacturer said last week, "We trained cinema usherettes in the war—we could do it again."

Meanwhile, let us have a look at the manpower of some other industries :—

Motor vehicles and cycles	307,000
Tailoring	278,000
Boots and repairs	145,000
Cosmetics and soap	96,000
Catering and hotels	653,000
Dry cleaning and laundry	185,000
Dressmaking	93,000
Toys and games	30,000
Printing and publishing	345,000
Drink	154,000
Cocoa, Chocolate and confectionery	82,000
Hosiery and knitted wear	125,000

Is there, even in this briefest of brief lists, nowhere from which 250,000 aircraft workers can be recruited without causing a revolution, and remembering the prize to be won?

The Chancellor of the Exchequer is, by economic measures, to put the "squeeze" on industries which in our present plight can be regarded as "fripperies." We do not know what manpower this will throw up or, more importantly, *when* it will do so. We do know, however, that, underlying the shortage of workers in the aircraft industry, is the sickeningly familiar cry of "No houses."

One manufacturer told me the other day that he was actually losing men rather than gaining them, because, as one of his ex-workers put it, "I am fed up with sharing a room with five chaps and my bed with two."

In the view of most, houses are *the* key—and to that great national problem there must surely be brought some form of priority or planning, call it what you will. I can only underline it in this present connection, and pass it by as being outside the scope of this article, even though most of my subject-matter stems directly from it. Housing today is "politics"—and to the politicians we must leave it.

Two other factors are raw materials and machine tools. As to the materials—I just cannot believe that for such easy "spinning into gold" they would not be made available. The machine-tool shortage is more real, but even on this there are divided opinions in the industry itself. The recent private remark of one of our biggest aircraft industrialists does, however, bear quoting: "Machine tools?" he said. "Of course they're short. But just give me the manpower and I'd do the job. After all, I know of nobody in the business who is double-shifting his tools yet." And nor do I.

Finally, I come to the point that Air Power is indivisible—a point so well summarized in the current *de Havilland Gazette* (and, incidentally, referred to by Sir Ralph Cochrane in his recent speech at Bristol, which may give us hope from the Air Staff end). The *Gazette* says :—

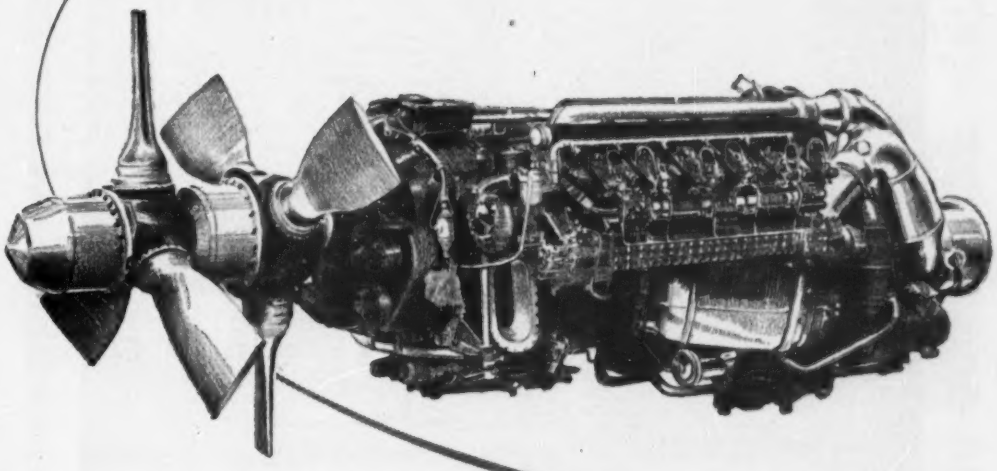
"No air force can be great unless backed by a strong merchant air service; rearmament alone calls for this, and for a strong commercial-aircraft industry to create and maintain it. Air power is indivisible; strength of military and civil operations and manufacture are its inseparable parts.

"Here is a great opportunity for export business in a branch of engineering and transport which is on the brink of an immense advance. The statistics of rising air traffic leaves no doubt of this. The opportunity is indeed more than great. It is unique. To disregard it would be as tragic as would have been the neglect of our maritime calling when Elizabeth was Queen."

AMERICA AND THE N.Z. RACE

AS we reported a month ago, Mr. H. W. Christie and Mr. John Stannage have travelled from New Zealand to America to publicize the 12,200-mile England-Christchurch Air Race, to be held in October 1953. Commenting on their visit, *American Aviation* says, "What with de Havilland anxious to show off the Comet, they hope to attract rivals from the U.S., but jet transport planes have been a little scarce on U.S. production lines of late. However, it is possible the U.S.A.F. might be persuaded to get into the race with something special in the military line in an effort to cop the speed prize. Make those reservations early, chappies. Christchurch is a long way from here and 1953 will be rolling around sooner than you think."

NAPIER NOMAD



Nomad — the first composite gas turbine/piston engine, is Britain's newest contribution to aircraft propulsion. A 3,000 h.p. engine with a standard of operating economy hitherto unachieved, it follows classic Napier designs whose names are prominent in the story of British achievement in the air.

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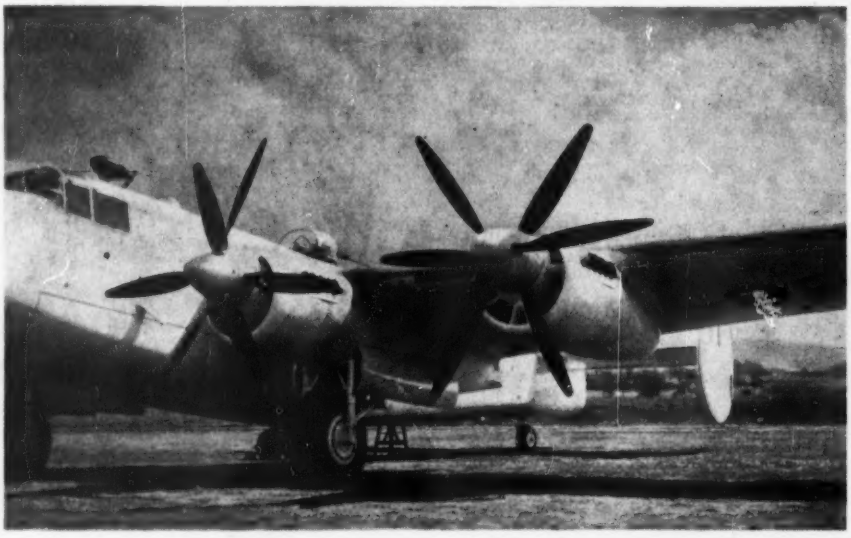
PROGRESS

Rolls-Royce produce turbo-jet, propeller-turbine and piston aero engines to suit all types of medium and high-powered aircraft



THE AVRO SHACKLETON MARITIME RECONNAISSANCE
powered by four Rolls-Royce Griffon engines

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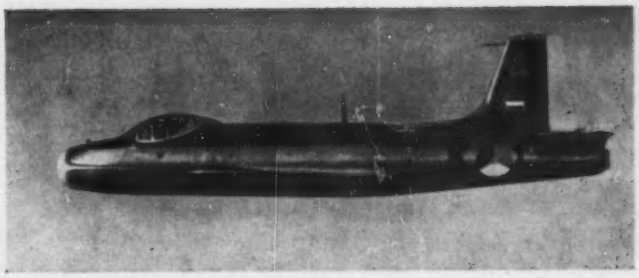


PROCEEDING SMOOTHLY according to the makers, are the current flight trials of the Fokker S.14 side-by-side jet trainer (Rolls-Royce Derwent turbojet). It may be recalled that the machine made its first flight on May 20th, 1951.

FROM ALL QUARTERS

The New Year Honours

THE names of several distinguished aeronautical scientists appear in the New Year Honours list, published as we go to press. Among them are Prof. L. Bairstow, C.B.E., F.R.S., F.R.Ae.S., chairman of the Aeronautical Research Committee since 1949, and Mr. D. R. Pye, C.B., M.A., Sc.D., F.R.S., M.I.Mech.E., F.R.Ae.S., Provost of University College, London, since 1943 and formerly Director of Research, Air Ministry, from 1937 to 1943; both become Knights Bachelor.

Among members of the industry who figure in the list are Mr. W. Lappin (who, at Derby, is responsible for Rolls-Royce liaison with the R.A.F.), and Mr. H. H. Burton, a director of the English Steel Corporation; both are made C.B.E.s. Similar honours go to Mr. H. L. Stevens, O.B.E., F.R.Ae.S., M.I.Mech.E., Principal Director of Equipment Research and Development (Air), Ministry of Supply, and to Mr. William Deane, Assistant Secretary, Air Ministry, and to Mr. W. W. Withers, F.A.I., chairman of the council of the R.A.F. Benevolent Fund.

A number of senior officers of the R.A.F. receive honours, details of which are given on p. 24. A list of the remaining Service and civil names of interest to the aviation community will appear in our pages next week.

Maiden Flights

IT is expected that test flights of the Bristol 173 helicopter (two Alvis Leonides) will take place at Filton during the next few days. The first of B.O.A.C.'s Proteus-powered Bristol 175 airliners (picture on p. 22) is likely to fly in time to appear at the S.B.A.C. Display.

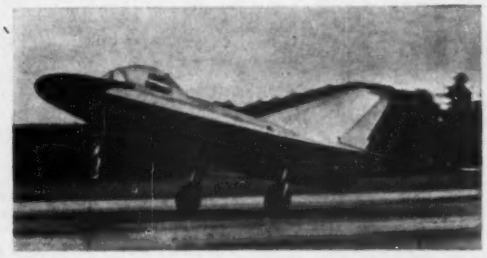
From America it is officially reported that the power plants of the eight-jet Boeing B-52 bomber have undergone ground-running tests at Seattle, prior to an imminent first flight.

A recent French "first" was the initial flight of an Atar 101 axial turbojet in a Marcel Dassault M.D.450 Ouragan fighter. The pilot was Col. Rozanoff, the date December 5th, and the airfield Melun-Villaroche.

Ambrosini (Gipsy Queen) Records

FLYING an Ambrosini S.7 single-seat trainer, Count Bonzi recently established a series of new F.A.I. class records in the 1,000-1,750 kg category.

The aircraft concerned was similar to that described in our "In the Air" series article (*Flight*, August 24th, 1951) but in place of the 225 h.p. Alfa 115, the record machine had a 250 h.p. de Havilland Gipsy Queen 30 with D.H. constant-speed airscrew.



SWEDEN'S FIRST DELTA: Designated Saab-210 Dragon, this experimental delta-wing aircraft has been undergoing taxying tests at Linköping, in Sweden. The power unit is an Armstrong Siddeley Adder turbojet, and, as on our own deltas, a braking parachute is provided. There is a "kink" in the leading edge. A twin-jet fighter based on the Dragon—which has not yet flown—is projected.

This version of the Queen has direct drive and is unsupercharged; it achieves its maximum power output at 2,500 r.p.m.

Count Bonzi's records are as follows: 100 km closed-circuit, 358.673 km/hr (222.84 m.p.h.); 1,000 km closed-circuit, 347.362 km/hr (215.85 m.p.h.). These speeds were 87 km/hr and 124 km/hr higher respectively than the previous records.

An Avon-Duchess

A LARGER, higher-powered version of the Saunders-Roe Duchess flying-boat, with six Rolls-Royce Avon turbojets in place of the de Havilland Ghosts specified for the first project, is announced. Data (figures for Ghost-powered machine bracketed) are: Span 138ft (135ft 6in); length, 125ft (124ft 6in); loaded weight, 150,000 lb (130,000 lb); max. speed, 559 m.p.h. (550 m.p.h.); most economical speed, 475 m.p.h. (468 m.p.h.). The Avon version would climb to 30,000ft in 14.6 min, and take off (10 m.p.h. wind) in 1,300 yd.

Two Recent Appointments

F/L. L. MASSEY HILTON, D.F.C., A.F.C., A.F.R.Ae.S., who has been appointed an additional assistant managing director of the Fairey Aviation Co., Ltd. He joined the company in 1931 (and its board in 1934) after service in the Royal Navy and the R.A.F.

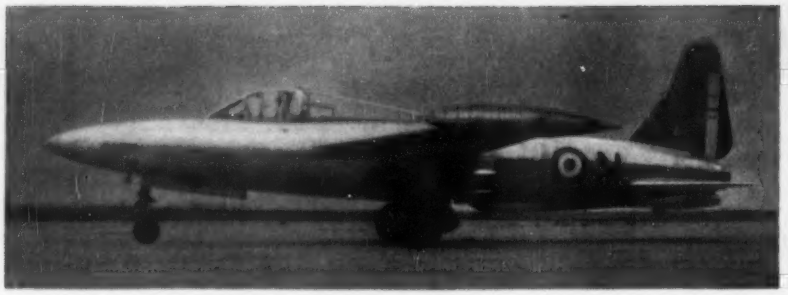
MR. P. E. GORDON-MARSHALL, who has joined the Bristol Aeroplane Co., Ltd., as executive assistant to Capt. K. J. G. Bartlett, director. He has had nearly 21 years' service in the industry, culminating in a directorship of Airspeed in 1946.

Communists Fine C-47 Crew £44,000

A FORTNIGHT ago we reported that American representations concerning the U.S.A.F. C-47 forced down by Russian fighters on the airfield at Papa, Hungary, on November 19th had met with the usual Soviet refusal to give information.

Further developments have since occurred. On December 23rd the C-47's crew of four, who had been languishing in gaol for a month, were brought before a military court on a charge of "violating Hungarian territory." It was alleged that they were "unable to give any satisfactory explanation of the intended use of the military maps, parachutes, blankets and portable radio found in the plane" and that "there was no doubt that they were intended for spies and disruptive elements in Hungary." (The U.S. notes of protest had previously explained that this was standard survival equipment.)

The trial was brief, and ended in the four men being fined some £11,000 each, with the alternative of three months' imprisonment. The C-47 was to be confiscated. On December 26th it was announced that the U.S. State Department would pay the fines, and that the crew would be released forthwith.



BOOSTED: This newest version of the French Espadon fighter is designated S.O.6026 and made its first flight on October 15th. Supplementing the Hispano Nene is a liquid-fuel rocket, mounted under the jet pipe and fed from the wing-tip tanks.

HERE AND THERE

Farnborough Date

THE 1952 S.B.A.C. Flying Display and exhibition is to be held from September 2nd (pre-view) to 7th. As usual, the public will be admitted on the two final days.

Satellite Migs

IT is known that jet fighters of Russian origin have been supplied to satellite countries and a Polish journal has recently published a drawing of (presumably) Mig-15s with Polish national markings.

A Big Turbom ca

WITHOUT interruption of its small-turbine programme the Turboméca concern is to undertake the design and construction of a unit of 13,230 lb thrust. This is intended to power new French fighters.

French Nene Production

THE Hispano Suiza company of Bois Colombes announces that it has now constructed 500 Nene turbojets under Rolls-Royce licence. Since the first was assembled in France, more than 6,000 hours of test-bed running and 2,300 hours of flight testing have been completed.

The C.A.S.

RUMOURS of the impending retirement of Marshal of the Royal Air Force Sir John Slessor from the post of Chief of the Air Staff have been denied. His three-year appointment dates from January 1st, 1950, and it is now stated "on the highest authority" that he will complete his term.

Brancker Memorial Lecture

THERE have been changes in the arrangements for the 1952 Brancker Memorial Lecture of the Institute of Transport. The subject is now announced as *The Flying-boat and its Place in Aviation*, and the lecturer is to be Air Chief Marshal Sir Frederick Bowhill, Chief Aeronautical Adviser to the M.C.A. He will deliver the paper at 5.45 p.m. on February 11th, at the Jarvis Hall, 66 Portland Place, London W.1. Visitors will be welcome.

U.S. Canberra Accident

THE first of the two English Electric Canberra jet bombers delivered to the Glenn L. Martin company, which will build the type for the U.S.A.F., was destroyed in an accident on December 21st. One of the crew of two—both U.S.A.F. officers—escaped by parachute and he is reported to have said that the tailplane came off in a dive. Commenting on the accident while waiting to leave London Airport for America, on December 26th, W/C. Roland Beamont, English Electric's chief test pilot, is reported to have said: "Too much importance should not be attached to it. We do not know what they were doing with the Canberra over there."

Payen Delta

THE French constructor Payen has designed a delta-wing aircraft which is almost complete and which will be pre-tested in the Chalais Meudon wind-tunnel.

All Laid On

THIS week, weather permitting, a helicopter operation new to Britain (though well-tried in America) was due to take place in the Malvern Hills. A power cable in a single 1,250ft span had to be suspended over a densely wooded valley; to follow the normal method of laying the cable on the ground and then pulling it up between the pylons would have involved the felling and/or lopping of hundreds of trees. It was therefore decided to employ a helicopter—a Hiller from Pest Control, Ltd. The plan was for the aircraft to reel out a stout line (weighing about 3 cwt), which, lying on the tree-tops, would then be used to haul a balloon-cable across the valley; this in turn would provide a means of pulling the heavy power-cable across.

Folland Appointment

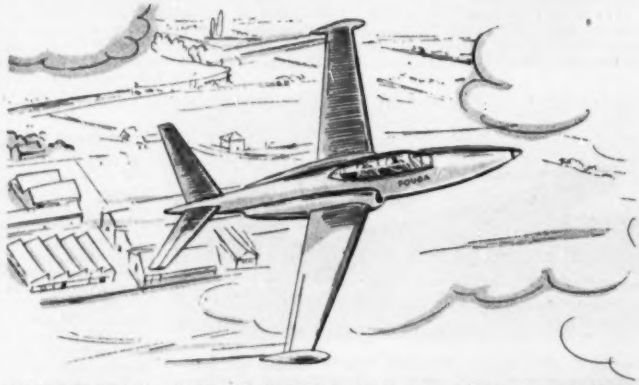
IT is announced by Folland Aircraft, Ltd., that Mr. F. H. Pollicutt, F.R.Ae.S., has been appointed chief designer to the company, with effect from January 1st. Mr. Pollicutt, who is 42, was apprenticed to the Royal Aircraft Establishment, Farnborough, where he served from 1924 to 1930. After leaving Farnborough he joined the Bristol Aeroplane Co., Ltd., as technical assistant. He was appointed chief of the stress department in 1938, chief technician in 1942, and from 1945 was assistant chief designer.

Danes in Canada

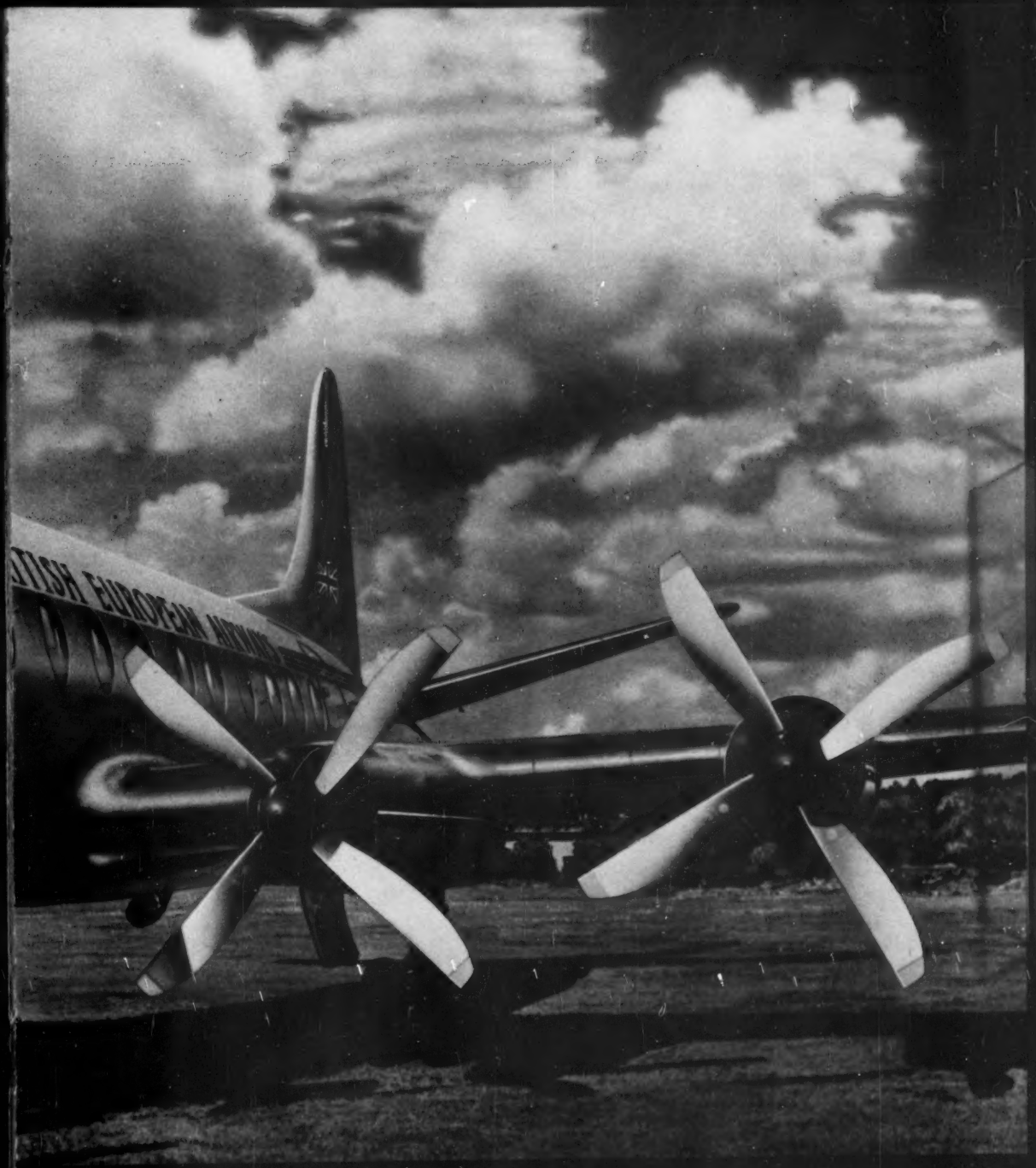
THE first seven of 23 Danish Air Force Trainees have reached Canada, where they are to fly with the R.C.A.F. under the N.A.T.O. air training scheme. They are receiving a pre-flight course at London, Ontario, and will then go to No. 2 Air Navigation School, Winnipeg.

An Escape Route Retraced

A FEW weeks ago a member of the R.A.F. Escaping Society, F/O. Barker, A.F.C., D.F.M., went back to the South of France and met again some of the people who helped him to elude the Germans when, in 1942, his No. 102 Sqn. Halifax was shot down near Dunkirk; with their help, he had made a 350-mile journey to the Swiss frontier, then another across Southern France to the Spanish border. His return visit was in company with two film technicians, and the various reunions were recorded for inclusion in Issue No. 382 of *Pathé Pictorial*, on show next week.



FOUGA FORECAST: That the Fouga C.M.170R twin-jet trainer, now under construction, will have a number of features in common with the Supermarine 508 fighter is shown by this drawing from the makers' Christmas card. The nose appears to have been altered since a model was shown in the Paris Salon, and wing-tip tanks have been added.



ROTOL PROPELLERS

ROTOL

GLOUCESTER · ENGLAND

Freight can be distributed both fore and aft in the Viscount, which means that any distribution of the load comes well within the C.G. limits. Hence, last-minute passenger changes present no problem to the operator of Viscount aircraft.

THE VICKERS VISCOUNT

FOUR ROLLS-ROYCE PROPELLER TURBINE ENGINES

TURBOPROPTER: Last July we reported that the Kaman Aircraft Corporation had received a U.S. Navy contract to develop a small gas-turbine-powered helicopter. The prototype—seen here—is now flying: it is basically a Kaman K-225 three-seat utility helicopter, the Lycoming engine of which has been replaced by a Boeing 502 gas turbine of 175 e.s.h.p.

HERE AND THERE . . .

The Breguet Vultur

THE composite-powered, deck-landing Breguet 960.01 Vultur (one Armstrong Siddeley Mamba and one Rolls-Royce Nene) is flying after modifications to the canopy and other components. The ailerons have received spring tabs and the second prototype, scheduled to fly next spring, will have power-operated controls. This machine, incidentally, will have a Mamba 3 in place of the present Mamba 1.

Flying Power-station

ELECTRICAL demands in the Saunders-Roe Princess are so great that 168 kW has to be generated. Four 39 kW generators on the four coupled Proteus power units supply the main 120-volt system, while two 6 kW generators on the single outboard Proteus engines provide the secondary 24-volt supply. A detailed description of the installation, in the December 28th issue of *Electrical Review*, will be of value to all aircraft electrical engineers interested in modern practice.

A.O.P. Sycamore

THE austerely camouflaged helicopter illustrated below is a Bristol Sycamore Mk II fitted with special equipment for A.O.P. and general military duties. Among this are a rope-ladder for picking up personnel from ground that is too rough for a landing; sunblinds to the cockpit roof; and provision for firing a Very pistol through the fuselage floor. Radio includes an A.62 set as used on jeeps and A.S.V.s, while a standard R.A.F. TR.1934 set replaces the STR 9X installed in the civil version. With five up, the helicopter operates at the normal Type 171 all-up weight of 5,200 lb. Now under development, incidentally, is a c.g. compensator comprising forward and after tanks (containing a water-glycerine solution) with selector valve and power switch lever.

IN BRIEF

THE British Aluminium Co., Ltd., announces that Mr. W. H. Platt, assistant sales manager (wrought products) has just retired after 41 years' service in the sales division of the company. Mr. C. F. Batstone is to combine the functions of principal assistant sales manager with those previously carried out by Mr. Platt.

* * *

Diverse industrial applications of "L.D.C." motors of various sizes are illustrated in a folder from Lancashire Dynamo and Crypto (Mfg.), Ltd., Trafford Park, Manchester 17.

* * *

The Shell Aviation Department is now accommodated at St. Swithin's House, St. Swithin's Lane, London, E.C.4 (telephone Avenue 7144); correspondence, however, should still be addressed to the Shell Petroleum Company's offices at St. Helen Court, London, E.C.3.

* * *

E. K. Cole, Ltd., announce the appointment of three executives as directors: Messrs. Frank S. Allen, M.I.P.E., John Corbishley, A.C.A., and Anthony W. Martin, M.B.E., Assoc.I.E.E. Three others become executive directors: Messrs. George W. Godfrey, M.I.S.M.A., David Radford and Walter M. York, F.I.A.M.A., M.I.S.M.A. Mr. York was largely responsible for the change-over of the Ekco factories from peace to war production, while Mr. Martin has outstanding achievements in radar development to his credit.

* * *

Mr. George Carr, upholstery sales manager at Dunlop's Walton factory, is going to Canada for a limited period to manage the Dunlopillo sales division of the Dunlop Canadian Company (Dunlop Tyre and Rubber Goods Company, Ltd.) located in Toronto.

* * *

Well known in many parts of the world in which P. and W.-engined aircraft operate, Mr. P. D. Doran has been appointed chief of commercial sales at Pratt and Whitney Aircraft, East Hartford, Conn. He was formerly head of the company's airlines engineering department.

* * *

Annual prizes totalling $1,500 are offered for aviation articles by six member-firms (Canadair, C.P.A., de Havilland, A. V. Roe, Rolls-Royce and T.C.A.) of the Canadian Air Industries and Transport Association. The competition is confined to Canadian writers resident in the Dominion, but their articles published in any part of the world during a twelve-month period are eligible.

(*Other Industry News on page 28*)

SERVICE SYCAMORE: The Bristol Sycamore Mk II helicopter, as modified for A.O.P. and general military duties, is now under test at Boscombe Down (see above). The view on the right shows the floor-tube to enable Very lights to be fired; when the pistol is withdrawn the tube is closed by a plug.

INSPIRATION

Dr. Seddon's R.Ae.S. Lecture on Air Intakes for Gas Turbines

IN presenting his lecture, *Air Intakes for Aircraft Gas Turbines*, before the Royal Aeronautical Society on December 6th, Dr. J. Seddon, Ph.D., A.F.R.Ae.S.,* said that the intake aerodynamicist might be said to exist on the eccentricities of side intakes. It was important that the necessity for compromise should be realized and borne in mind. There were not the resources in Great Britain for thorough investigation to be made of every flow problem that arose, and only by holding firmly to the target of a practical design with good all-round efficiency could British designers keep in the forefront of progress.

The lecturer said that his paper was concerned with the air intake as a field of aerodynamic problems and not with overall performance comparisons. Physically, the air intake was taken to mean the complete engine air ducting system upstream of the compressor inlet, and was thus normally that part of the installation for which the aircraft designer was primarily responsible. On a typical single-engined turbojet aircraft, the total entry area of the intakes amounted to a little under 1 per cent of the wing area, or about 15 per cent of the maximum frontal area of the body. The total intake volume had in the past usually been between 10 and 30 cu ft, this representing on the average about 5 per cent of the total cubic capacity of the fuselage. The importance of maintaining high intake efficiency was illustrated by the fact that, at a flight Mach number of 0.9, a 10 per cent loss of intake adiabatic efficiency resulted in from 7 to 10 per cent loss of sea level static thrust, and from 2 to 4 per cent increase in specific fuel consumption. At a Mach number of 1.2, these penalties were increased by more than 50 per cent.

Most of the problems of intake design were connected with the flow processes occurring in the immediate neighbourhood of the entry, where the separation between internal and external flow took place. The distinguishing parameter was the entry velocity ratio (the ratio of flight speed V_0 to mean entry velocity V_1) and the values typifying the four regimes were: $\frac{V_0}{V_1} = 0$, 1, 2, and 3. For convenience and to indicate where the problems lay, the four regimes would be labelled the static, climb, level flight and dive conditions respectively.

In the static case, the air accelerated into the entry from all directions. The velocity over any wetted surface external to the duct was low, and so the effect of external boundary layer was generally negligible. On the other hand, pressure gradients round the lips were severe, and this led to rapid boundary-layer development just inside the entry or, in some cases, to separation. It was clear that lip radius would play a major part in determining the extent of losses arising in this way. As the aircraft speed was increased, with V_1 more or less constant, the relative acceleration into the intake decreased rapidly until, in the climb condition, the air flowed into the entry with practically no change in speed or direction. As might be expected, most designs showed a minimum loss near this condition.

The third regime was that of level flight at or near top speed. In this case, the air decelerated to about half speed between the free stream and the entry. Losses in the boundary layer on wetted surfaces ahead of the entry now played an important part, firstly because they accumulated at much higher velocity than that inside the duct, and secondly because the adverse pressure gradient accompanying the pre-entry retardation might cause the boundary layer to separate. This flow-pattern also indicated the high velocity region on the outside of the lip, which determined the critical Mach number of the intake. The excess velocity was accounted for partly by the thickness and shape of the lip, and partly by the pre-entry retardation which effectively set the lip at a positive incidence.

In the dive case, with a non-pitot-type intake, there was an increased tendency for the boundary layer to separate in the region of adverse pressure gradient. It was convenient to regard this case as a separate condition, because the practical implications were different from the previous one. The concern was not so much for high intake efficiency as for the possibility of aircraft vibration and other effects of separated flow.

Dealing with pressure recovery and the significance of position ratio, Dr. Seddon went on to say that the pressure recovery of a subsonic air-intake was equal to the available isentropic pressure rise corresponding to the forward speed of the aircraft, less the total effect of all losses occurring between free stream conditions and those at the compressor inlet. A new intake design of doubtful efficiency would usually be given a low-speed wind-tunnel test. This provided a check on the suitability of the chosen entry area, an opportunity to modify the detailed shape of the duct, and the necessary data to decide whether special devices, such as a boundary layer by-pass, would be required.

Excluding plenum-chamber installations and turboprops, these measures could normally be expected to take the development up to a stage where all flow-separations were suppressed, and the losses were reduced to those arising from skin friction in a field of varying velocities and pressure gradients. Analysis of past results showed that, in these circumstances, the most important factor which discriminated between one design and another was the quantity and state of external boundary layer taken into the duct from the approach surfaces.

Most developed intakes showed efficiencies of more than 90 per cent. To achieve this result often required the use of a boundary layer by-pass, as in the Attacker. A by-pass removed a proportion of the approach boundary layer and so reduced the effective position ratio of the intake. With a full set of measurements of intake loss, both with and without by-pass, the effective position ratio could be deduced for the case with by-pass present. A proportionate reduction in S/A_1 might be taken as defining the by-pass efficiency. This efficiency for the Attacker by-pass, for example, was about 70 per cent. The use of a by-pass improved the ram efficiency of the intake by about 11 per cent. A 100 per cent efficient by-pass would effectively convert the intake to pitot type.

Blade Root Loss on Turboprops

Another important form of intake loss which came outside the category of frictional losses was that caused by the blade roots on a turboprop installation having the conventional arrangement of an annular intake close behind the airscrew(s). Wind-tunnel model tests had shown that, in a typical case, the total intake loss might be about 25 per cent ram, of which 15 per cent was attributable to the blade roots. The flow over the roots was complicated in character because of the large thickness/chord ratio of the root sections, and the existence of centrifugal forces acting on the boundary layer. As a result, there was little advantage to be gained by having flared roots with large root chords, and if these involved an increase of actual section thickness, the effect might be detrimental.

Modern blade-development was more in the direction of producing thinner roots, and this was a surer way of reducing the intake loss. A good, modern, four-blade airscrew on an engine like the Mamba might be expected to have a blockage ratio of the order of 16 per cent, and would therefore be responsible for the loss of about 8 per cent ram in the intake. An alternative way of obtaining an increase in intake efficiency with a turboprop installation was by means of a ducted spinner. This gave a large reduction in velocity over the blade roots, and effectively converted the intake itself to pitot type. The advantage of the (Napier Naiad) ducted spinner amounted to 19 per cent ram, and resulted in giving 90 per cent efficiency. The main disadvantages of the ducted spinner were its weight, and the difficulty of providing protection against ice.

It had been shown that the pressure recovery of a subsonic intake in high-speed flight depended primarily on three factors: (i) the intake position ratio, (ii) whether the engine was of the direct inlet or plenum chamber type, and (iii) whether the method of propulsion was by turbojet or by turboprop. If either plenum-chamber loss or blade-root loss was present, this tended to dominate the picture. But the influence of position ration was just as great as for direct inlet turbojet engines.

Dr. Seddon said that to put a few well-known examples into

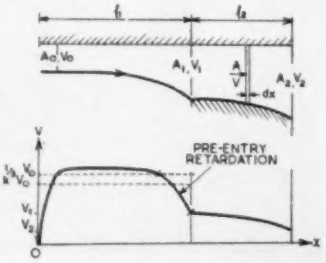


Fig. 1. Diagram of intake flow and velocity variation.

*Dr. Seddon is Principal Aerodynamics Officer, Royal Aircraft Establishment.

perspective, the Vampire intake (96 per cent) had a low position-ratio and a direct inlet; cases such as the Meteor (88 per cent) and Attacker (85 per cent)—these being values converted to constant plenum-chamber conditions—were dominated by the plenum-chamber loss; on the other hand, turboprop intakes (82 per cent in a typical case) had the blade-root loss which was 8 to 10 per cent for the average airscrew, and also a high position ratio.

No radical change in the picture was to be expected up to sonic flight speed since the relevant flow field in most cases was wholly subsonic. At supersonic speeds, the deceleration to compressor velocity had to take place in part through a shock system in which further loss was incurred. At speeds only slightly above a Mach number of 1.0, it might be that this loss would add to the subsonic losses without further complication. Later, the interference effects between shock-wave and boundary layer were likely to become important. Whatever the outcome, the experimental and analytical methods which had been used in the past might be expected to prove useful and reliable in exploring the future.

The lecturer then took the opportunity briefly to present the details of a simple semi-empirical theory of intake loss for sub-

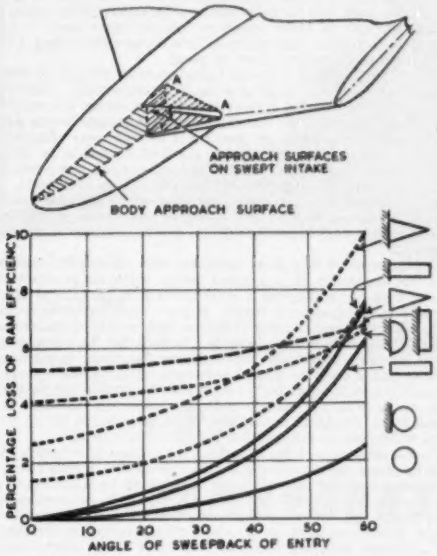


Fig. 2. Calculated approach losses for wing root intakes with entries of constant area A_1. Shading indicates body wall. Body length ahead of entry $=4\sqrt{A_1}$. $V_o/V_1=2{\cdot}0$. $c_f=0{\cdot}005$.

sonic intakes of the direct or fully-ducted type. The approach, so far as he was aware, had not been given before, and it provided a method of estimating the loss characteristic—and hence the ram efficiency—of a new design over the range of flight conditions from climb ($V_o/V_1=1.0$) through level flight ($V_o/V_1=2.0$) up to the highest velocity ratio which avoided boundary layer separation ahead of the entry. If the additional lip losses in ground running were known, the complete characteristic from $V_o/V_1=0$ could be constructed. Important design-values such as the velocity ratio for optimum ram-efficiency or the limiting value for stable flow in twin-intake systems were easily derived.

Considering the flow into an intake as shown diagrammatically in Fig. 1, the length l_1 represented the approach length, or length of wetted surface ahead of the entry, whilst the length l_2 represented the enclosed duct from entry to compressor inlet position. It was assumed that the flow was incompressible, free from separations and fully mixed throughout, i.e., the speed and direction were uniform across any section normal to the axis of the duct.

At an arbitrary section (velocity V, total stream tube area A) the friction force on an element of wetted surface was

$$\delta F=\tfrac{1}{2}\varrho V^2 c_f P dx,$$

where c_f was the skin friction coefficient, and P was the length of wall round the section in contact with the flow (inside the duct P=total perimeter). The equivalent pressure drop was

$$\frac{\delta F}{A}=\tfrac{1}{2}\varrho V^2 c_f \frac{P dx}{A},$$

and the loss of total head in the intake was given by an integration of this pressure drop over the full length. Hence if ΔH was the total head loss, and q_1 the mean dynamic head at entry $\tfrac{1}{2}\varrho V_1^2$,

$$\frac{\Delta H}{q_1}=\int_o^{l_1+l_2} c_f\left(\frac{V}{V_1}\right)^2\frac{P dx}{A} \qquad (1)$$

$\Delta H/q_1$ was termed the intake loss coefficient. Its relationship to the ram efficiency η_R was:

$$\frac{\Delta H}{q_1}=(1-\eta_R)\left(\frac{V_o}{V_1}\right)^2 \qquad (2)$$

A loss coefficient of 0.1 corresponded to about 2 per cent loss of thrust.

The integration was considered in two parts. Inside the duct the equation of continuity could be used to substitute known areas for velocities. On the external approach, the velocity varied in some such way as that shown in the diagram. Since (a) it was known from experimental evidence that the pre-entry retardation took place in a short distance ahead of the entry, and (b) the effects of a stagnation region near the nose of a fuselage and the excess velocity on the shoulder would largely cancel, it followed that the friction loss on the approach was not greatly different from what it would be if the velocity was uniformly V_o. The assumption was therefore made that the velocity on the approach could be replaced by a constant value $V=kV_o$ in which k was an empirical constant, the value of which was near 1.0. Assuming further that c_f was constant, the integration in equation (1) gave

$$\frac{\Delta H}{q_1}=c_f\left[1+k\frac{S}{A_1}\left(\frac{V_o}{V_1}\right)^2\right]. \qquad (3)$$

in which S/A_1 was the position ration and I was a duct integral defined by:

$$I=\int_{l_1}^{l_1+l_2}\left(\frac{A_1}{A}\right)^2\frac{P dx}{A}. \qquad (4)$$

The value of I was calculated from the shape of the duct. For a circular pipe of constant diameter,

$$I=4\frac{length}{diameter}$$

which led to a well-known formula for the pipe loss.

Equation (3) was the loss equation for an intake without boundary layer by-pass in fully turbulent flow. In analysing model tests, it might be necessary to distinguish between the values of friction coefficient for the approach and duct, because of the possibility of laminar flow on the approach. Further, if a by-pass was present, this reduced the effective position ratio by a factor representing the by-pass efficiency. Writing ϕ for the ratio of c_f on the approach to that in the duct, and η_b for the by-pass efficiency, gave the more general form:

$$\frac{\Delta H}{q_1}=c_f\left[I+\mathcal{J}\left(\frac{V_1}{V_o}\right)^2\right] \qquad (5)$$

where $\mathcal{J}=k\phi(1-\eta_b)S/A_1$. The corresponding ram efficiency was:

$$\eta_R=1-c_f\left[I\left(\frac{V_1}{V_o}\right)^2+\mathcal{J}\left(\frac{V_o}{V_1}\right)\right]. \qquad (6)$$

The loss coefficient formula was well substantiated by the results of low-speed model tests on intakes both with and without boundary layer by-passes. In compressible flow, the equation became, to a first approximation:

$$\frac{\Delta H}{q_1}=c_f\left[I+\mathcal{J}\left(\frac{\varrho_o}{\varrho_1}\right)^2\left(\frac{V_o}{V_1}\right)^2\right] \qquad (7)$$

Direct experimental confirmation of this form was, however, required.

Leading-Edge Intakes

Going on to consider the intake in the wing leading edge, Dr. Seddon observed that, on a straight winged aircraft, the wing leading edge provided an alternative region of pitot pressure for the designer who was unable to find room for an entry in the nose. Even if the intake was in the wing root, it was normally less affected by the fuselage boundary-layer than one which was built on to the side of the body. But with the use of swept wings came a new problem. Did the efficiency of the leading edge intake alter with sweep-back? By analogy with a yawed pitot-tube, the internal pressure might be expected to fall off with increasing angle. In fact, if the entry velocity ratio was near unity, sweep-back as such had no effect on intake efficiency. But at high forward speed, when the air was retarded in front of the entry, the pitot-tube analogy held.

This could be explained in the way illustrated in Fig. 2. The effective entry was the first completely closed section normal to the line of flight (A-A in the diagram) because it was here that the air had finally decelerated to duct speed. Hence all wetted surfaces ahead of this section counted as external approach area S, and boundary layer generated on these surfaces (indicated by arrows in the diagram) was in a similar category to that which came from wetted area on the fuselage. This meant that the swept leading-edge intake had a non-zero position-ratio, and therefore gave a lower ram efficiency than a similar un-swept intake.

The amount of loss depended not only on the angle of sweep-

INSPIRATION . . .

back, but also on the shape of the entry. Fig. 2 showed the results of calculation of the variation of approach loss with angle of sweep-back for entries of various shapes, both when isolated and also when adjacent to a body of fixed length. The results assumed no boundary-layer lip or by-pass but, where necessary, special forms of by-pass could be devised to reduce the loss caused by sweep-back.

Against the growing disadvantage of a swept intake, from the viewpoint of internal efficiency, had to be set possible advantage in improved external flow. Whilst on a high subsonic swept-wing design the intake in almost any other position was a liability, the wing-root intake provided, potentially, a useful form of blending between wing and body. The flow round it had something of the character both of that on the isolated swept wing and of that on the three-dimensional body, so that the intake was well-suited to make the transition from one to the other.

Referring to the N.A.C.A. submerged intake, the lecturer said that the efficiency obtained was very much the same as that given by a protruding side-intake in the corresponding position, equipped with a conventional by-pass. A problematical point was the relative external drag of two such intakes. Whilst the more conventional layout had to pay something for its efficiency by way of drag in the by-pass duct, it was equally undeniable that the submerged intake must carry a drag penalty in the form of energy-loss in the vortex motion on the ramp and in the mixing process behind the entry.

Dr. Seddon next turned his attention to lip losses in ground running, saying that, in order to get the best performance at high speeds, intake lips needed to be fairly sharp. As entry lips got thinner and entry area smaller, it became increasingly difficult to meet requirements, and nowadays special measures might be needed. One solution was to provide an auxiliary inlet which functioned only under static and low-speed conditions. On a number of plenum-chamber installations this had been done by the simple and convenient method of fitting one or more spring-loaded doors in the wall of the plenum chamber.

Slotted Intakes

An alternative device suitable for fully-ducted intakes was the slotted intake. In addition to providing auxiliary entry area, the slot worked in a manner analagous to that of a wing leading-edge slot for lift control, the inside of the duct corresponding to the upper surface of a wing. The slot should eject backwards into the duct, and be of sufficient length/width to have good directional control of the air. The use of a slotted intake would enable a designer to employ a smaller main entry and thinner lips, i.e., to match the design more closely to the conditions of high-speed flight.

A problem of some consequence arose when the plane of the entry was not normal to the axis of the duct, as occurred with an intake in the leading edge of a swept wing. Under static conditions, the average direction of flow at the entry was more or less normal to the entry plane, so that effectively the air required to be turned through an angle roughly equal to the angle of obliquity of the entry.

In model tests of twin-intake systems—as, for example, a pair of wing-root or body-side intakes leading into a common duct or plenum chamber—it had been observed that, if the total duct-flow was reduced below a critical value, the distribution of flow between the two intakes became unsymmetrical. The asymmetry developed rapidly, often to the state where the flow in one duct was actually reversed in direction. This resulted in a highly unsymmetrical velocity distribution at the compressor, a reduced pressure-recovery, and the possibility in flight of oscillating flow resulting in aircraft vibration. The appropriate flight condition would be in a dive at high speed, or on suddenly throttling back the engine while flying at moderate speeds.

It was an example of flow instability which was always an inherent possibility in a ducted system having a rising pressure-characteristic (one in which the internal pressure increased with increase of flow). The state of equilibrium tended to be unstable, because any momentary change in the flow altered the pressure in a direction tending to increase the disturbance. A pitot-type intake gave full ram-pressure at zero flow, and a falling characteristic over the whole range. With a side intake, the pressure at zero flow was below the pitot value, and as the flow was increased, the pressure first rose to a maximum and then fell. Instability was possible in the range between zero flow and the value for which the intake pressure was a maximum.

It was desirable with twin intakes that the critical flow ratio should be as low as possible. The value could be calculated by use of the intake loss formula, and the approximate result was:

$$\left(\frac{V_1}{V_0}\right)^2_{crit} = \frac{\gamma_{cf}}{2}\left(\frac{A_2}{A_1}\right)^2 \qquad (8)$$

where A_2 was the area of each duct at the mixing section, and the other notation was as before. This led to two important conclusions:

(i) A large amount of diffusion in the duct increased the critical value. For this reason, plenum-chamber intakes were more susceptible than direct inlets.

(ii) Since $\mathcal{J} = k\ (1 - \gamma_p)S/A_1$ the effective position ratio was the principal determining factor. Thus the use of a good boundary layer by-pass in addition to increasing the intake efficiency, would reduce the possibility of flow instability.

Dr. Seddon stated that he had discussed the problem purely in relation to a wind-tunnel-model intake system, with free flow, i.e., without engines. This left aside the question of the possible effect of an engine in stabilising the flow.

On the subject of drag the lecturer suggested that the intake-drag problem obviously had much in common with the drag problem of any other principal component, and of the aircraft as a whole. The emphasis of modern research had clearly to be centred on the effects of compressibility at high subsonic and at supersonic Mach numbers. Low-speed wind-tunnel tests were useful in defining the basic pressure-field in subsonic flow, but theory was not yet powerful enough to predict from this the actual drag at transonic speeds, and the great need was for experimental evidence at the appropriate Mach numbers. At the same time, it was important to keep a check on basic items of sub-critical drag, such as the drag of a boundary-layer by-pass.

The drag associated with the boundary-layer by-pass or other corresponding device merited a careful examination. Unfortunately, the conventional type of by-pass, consisting of a narrow ducted slot separating the main intake from the neighbouring wall, was notoriously difficult to install and to lead away efficiently. Friction loss added up quickly, so the duct needed to be short. This usually meant that it was not too well shaped, and probably discharged back into the external stream at a fairly large angle. It was not possible to generalize on the total cost in drag, but model tests of a few cases had shown that, unless care was taken, the drag might nullify the improvement in thrust obtained from the by-pass.

On the score of drag from compressibility effects, Dr. Seddon said that in practice, on a subsonic design, it was not so much the rate of drag-rise which had to be controlled, as the critical Mach number at which the rise began. A good subsonic intake would have a critical Mach number at least as high as that of the aircraft wing. This was not easily achieved, because the local conditions at the intake lip were often more stringent than those on the wing. The lip had to meet the general requirements of fineness-ratio and shape common to all parts, but there was the further complication that, owing to the pre-entry retardation, the lip was effectively at a considerable incidence to the flow. This exaggerated the suction peak which was the criterion for critical Mach number.

In the early days of model testing, the process of obtaining the best lip shape was one of hit and miss. Nowadays, a more rational procedure could be adopted owing to the work by Küchemann at the R.A.E., and by the N.A.C.A. in America. The position, stated very briefly, was that an intake fairing designed for a given critical Mach number required to have (a) a certain minimum thickness, (b) a certain optimum length and (c) good shape within fairly narrow limits. The minimum thickness was that which was necessary to carry the thrust force on the outside of the fairing without exceeding the value of suction coefficient corresponding to the stated critical Mach number.

The criterion of good shape was the "constant velocity profile" first derived by Ruden. This was calculable in terms of flow ratio and critical Mach number, and corresponded both to minimum thickness and optimum length. It might be said that, taking critical Mach number as the criterion, present knowledge showed how to obtain the best design for a given set of conditions—entry area, maximum fairing area, and entry velocity ratio—so long as these conditions were reasonably normal. When deciding on his final compromise, the designer could take this aspect into consideration in a qualitative way. Dr. Seddon concluded with the observation that, however, much more experimental evidence was needed before it could be determined quantitatively how the drag built up above the critical Mach number and in the supersonic range.

AIRCRAFT RECOGNITION SOCIETY

THERE was a record attendance at the Aircraft Recognition Society's "Brains Trust" held in the R.Ae.S. Library on December 19th, when the "brains" were Capt. J. Lawrence Pritchard, Mr. Arthur Clarke, Mr. Lankester Parker, Prof. A. A. Hall and Mr. N. E. Rowe.

Later, prizes were presented to winning contestants in the Society's Christmas Quiz; among the awards were some fine photographs of the P.1067, given by the Hawker Siddeley Group, and copies of Pierre Clostermann's book *The Big Show*, presented by the publishers.

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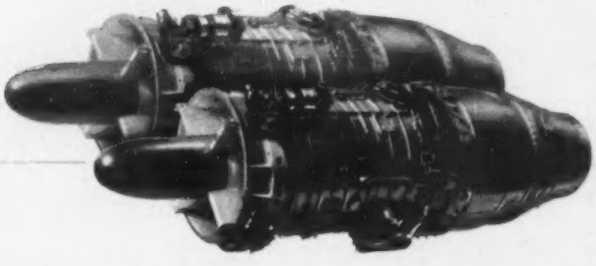

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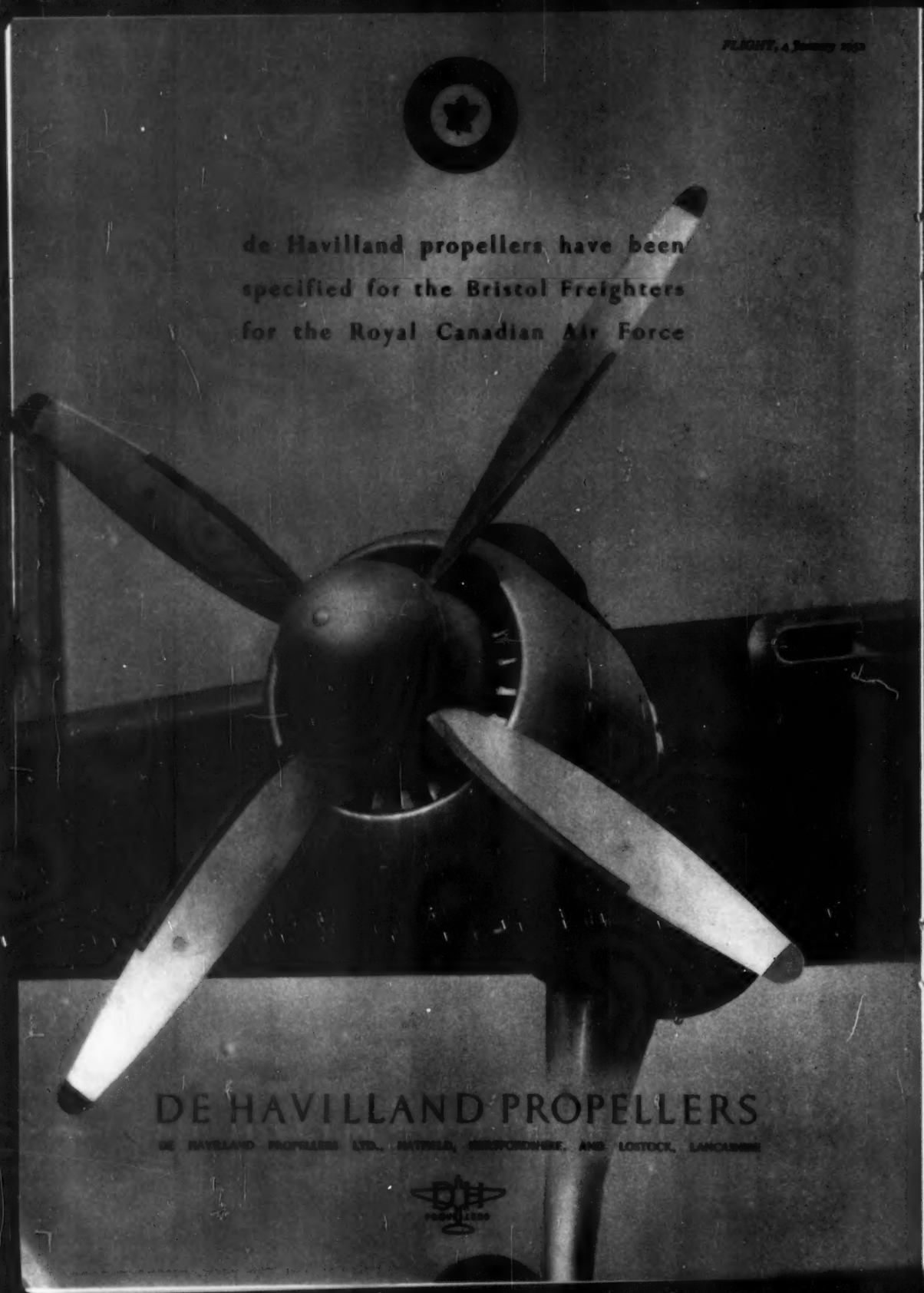
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"NON-SKED" VERSATILITY

Diverse Duties and Heavy Loads for the Yorks Operated by Eagle Aviation

The 13,000 lb ship's propeller-shaft seen (above) being loaded into one of Eagle's Yorks is by no means the largest that the company has been asked to carry; one item of a similar nature weighed over 18,000 lb.

A further stage in the loading of the 13,000-lb propeller-shaft, a process which took five hours.

The York's wide freight-doors make for the easy handling of all cargo—in this case a quantity of automobile components.

Bulky items like this trailer fire-pump are easily carried in the spacious hold of the York.

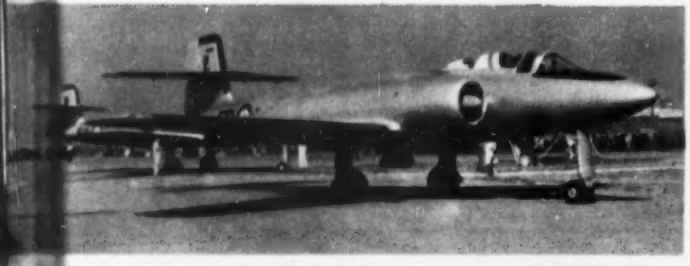
IN view of today's world-wide demand for large capacity, long-range charter aircraft a few companies which were in a position to purchase such equipment a year or two ago are now enjoying a period of particularly keen business. One of them is Eagle Aviation, Ltd. who, based at Luton Airport, use a fleet of four Yorks on a wide variety of long-haul passenger and freight duties.

With its cabin capacity of 1,835ft and its good range/pay load characteristics the York is in many ways an ideal freighter and Eagle have been able to establish for themselves a reputation for dealing with unusually heavy or awkward loads. Having a low-slung fuselage (only 3ft from the ground) the Yorks are also easy to load; lorries can be backed up to the freight-doors and their loads can then be transferred directly to the aircraft, thus eliminating the cost of extra stages in handling.

For passenger flights the machines have been equipped with "coach-class" accommodation for 45 persons, plus provision for full luggage allowance. The company's recent loads have included many parties of ships' crews, tourists, pilgrims and passengers carried on War Office charters, while among freight lifted was one of the heaviest single pieces of machinery ever to have been carried by air—an 18ft ship's propeller-shaft weighing some 8¼ tons. A current contract involves the evacuation of Korean casualties from Iwakuni, Japan.

Since it started operations in April 1948 with one converted Halifax the company has also expanded its activities to include a fully equipped maintenance and overhaul base—located at Luton—which undertakes outside work. The Luton Flying Club is also owned and operated by Eagle Aviation, Ltd.

FOR FIGHTING IN DARKNESS AND DIR



ILLUSTRATED here are eight types of night and/or all-weather fighters of Briti design. All are in service, or have been or the page, with its newly-installed wing-tip N.F.11, developed from the original Glo Armstrong Whitworth Aircraft, Ltd. Like as seen to its right, the Meteor N.F.11 i (The actual Vampire depicted is for the Ita from the Vampire are the Venom N.F.2 (im deck-landing Sea Venom N.F.20, shown in The two Canadian fighters seen on the gr Canada CF-100s, and below them is a line o awaiting flight-testing or delivery in Californ may be compared with the smaller Lockhee right. Finally—below these words—is the a twin-jet deck-landing type serving with th

TY WEATHER

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a. These massive machines
d F-94Bs shown at bottom
Douglas F3D-1 Skynight,
e U.S. Navy.

THE CHANNEL WING

"First Change in Basic Design of Aircraft Since the Wright Brothers"

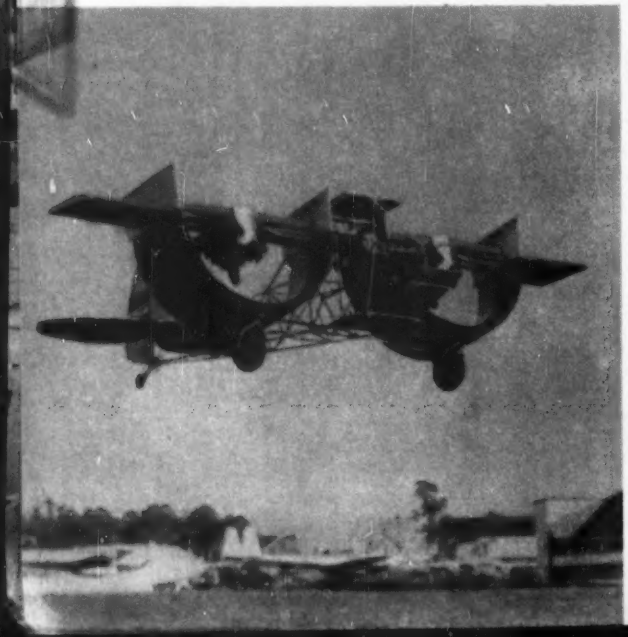
Static lift demonstration. The aircraft is tethered, and as may be seen, its wheels are about 12in above the ground. The static lift registered was 1,144lb.

THE statement in the subtitle above was made of the Custer channel wing by Mr. C. Gilbert Taylor, vice-president of Taylorcraft, Inc., at the inaugural demonstration of what is known as the channel wing, at Pittsburgh on December 6th. Mr. Taylor has a position in the aviation world such that his opinions are not lightly to be dismissed, and certainly the claims made for this new concept of aircraft design are impressive.

The wing, as may be seen from the illustrations, comprises a semi-circular duct of aerofoil section surrounding an engine on the axis of the duct and with an airscrew at the trailing edge. By virtue of the enhanced pressure reduction over the "upper" surface of the wing (i.e. the "inner" surface of the duct) associated with venturi effect, and resulting from the high velocity mass flow induced by the airscrew, it is claimed that the new wing form enables a powerful lifting force to be created by the surface without forward motion. This in turn means that an aircraft equipped with channel wings could, by the creation of vertical lift, rise vertically and hover in mid-air as well as being able to fly at normal speeds.

The claims made by the Custer Channel Wing Corporation of Hagerstown, Maryland, are to say the least, sweeping. It is stated that the wing in full scale has already demonstrated statically an infinite lift coefficient. (This has the appearance of being a technical trick in which the speed of airflow through the duct is disregarded, but, since the machine is at rest, V^2 is taken as 0.)

Here seen flying at 30 m.p.h. after a take-off of but 45ft, the aircraft has a gross weight of 1,124lb and a "wing" area of 35 sq ft.

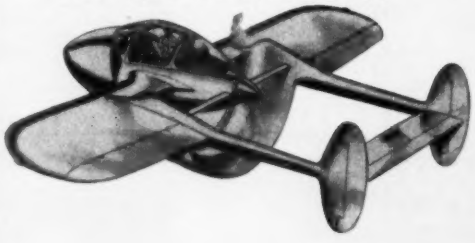


It is further stated that, although a "ship" with channel wings can rise or land vertically and can hover as can a helicopter, a "ship" with channel wings can attain forward speeds impossible for a helicopter and in excess of those obtained by any fixed wing aircraft. Indeed, it is further stated in this context that the company's test data indicate "that a properly designed ship with channel wing will attain supersonic speeds and will be able to land at less than normal landing speeds of today without the assistance of flaps, slots, etc." On the score of safety, it is claimed that the channel wing provides complete control in yaw, pitch and roll at low speeds, and that the glide characteristics are comparable with those of conventional aircraft, with the added advantage of slower landings.

The company's calculations are stated to show that the range and endurance of aircraft equipped with channel wings will be far superior to those of conventional types, although the actual improvement will depend upon the manner of application of the wing, but the company express the view that it is evident that the unusual efficiency of the channel wing at both high and low speeds will greatly extend the range of the aircraft and will provide more economical operation.

Taylorcraft, Inc., of Conway, Pennsylvania, are the first manufacturers to be licensed by the Custer Corporation for the manufacture both of military and private aircraft. The first Taylorcraft type that will be projected on an experimental basis will be a military aircraft to comply with the (U.S.) Air Force specifications for a liaison aircraft. It will carry a pilot and three fully equipped combat troops, or ten litter patients and one medical attendant. It will have at least five hours' cruising range and be able to land on and take-off from unprepared surfaces. The useful load will exceed 1,000 lb exclusive of the pilot, and the normal cruising speed will be 150 knots or better.

A Taylorcraft advertisement shows this aircraft, in which the channel wing is applied to a basically conventional layout.



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METEOROLOGY and NAVIGATION

The Importance of Upper-air Data: a Lecture to the Institute of Navigation

IN presenting his paper under the above title before the Institute of Navigation on December 21st, Lt. Cdr. P. G. Satow, D.S.C., R.N., said that, unlike the marine user, the airborne navigator was generally in no position to take far-reaching avoiding action or to await improved conditions. Aircraft without navigation facilities had to be controlled from ship or shore, and the controller had to have a complete picture of upper winds, cloud and temperatures up to maximum operating heights. Aircraft with navigational facilities required careful flight-planning before they took off, and detailed forecast data for the intended flight. Lastly, and perhaps most important, they required forecasts for their intended terminal airport and for diversion airfields.

Upper-air charts were constructed, not for selected altitudes, but for suitable pressure-levels. Contours of the 1,000-millibar level were first drawn: the vertical thickness pattern was then added graphically to obtain contours for 700 mb (approximately 10,000ft). Observed upper winds were taken into account in drawing the contour lines.

This procedure was continued up to 500 mb (approximately 18,000ft) and to 300 mb (approximately 30,000ft). Up to the present, most long-distance flights had been made at heights not exceeding 25,000ft. For these, charts and forecasts up to 300 mb had been adequate.

The Series 1 Comet (D.H. Ghost turbojets), to be brought into operation shortly by British Overseas Airways Corporation, had a normal peak cruising altitude of about 40,000ft (approximately 190 mb). The Series 2 Comet (Rolls-Royce Avons) was expected to reach 45,000ft (approximately 150 mb).

British upper-air bulletins had been extended to include the 200 mb (approximately 39,000ft), and 100 mb (approximately 54,000ft) levels, for which observed and predicted contour charts were now being issued twice in every 24 hours. Although these charts were built up from 300 mb, observed data were often sparse at these heights, and most countries had agreed to extend their soundings to reach the 100 mb level as soon as practicable. By so doing, each country would be assisting her own ground-forecasting services in addition to making valuable contributions to air navigation.

Air temperatures were assuming a greater importance, mainly at take-off, when a rise of 1 degree would cause a loss of power from the gas turbine five times greater than with a piston-type engine.

Operation of these new British air liners would provide valuable in-flight reports from high altitudes. In approaching air terminals a high percentage of correct landing decisions—at present generally made by the pilot descending to see for himself—were required. If diversions could be made whilst still at cruising height, a great deal of extra fuel need not be carried in favour of additional payload.

However, neither pilots nor passengers would accept diversions which would prove subsequently to have been unnecessary. To be successful, this procedure would entail a considerable advance in detailed local forecasting, and the closest co-operation between the airline operator, the air-traffic controller and the duty forecaster.

Tables of equivalent headwinds on some principal world air routes were already proving of great value to operational staffs for long distance flight-planning.

Upper-air analysis was being made at 14 standard pressure levels, from the surface up to 40 mb (approximately 72,000ft). It was being carried out by a new branch of the Meteorological Office, which was believed to be the only existing organization of its kind.

The strongest winds were to be found in the upper half of the troposphere, and velocities generally decreased on entering the lower stratosphere, where some flights of the Avon-Comet would be made.

To meet the new requirements of gas-turbine aircraft at high altitudes, "strong-wind warnings" were being issued in the U.K. for expected upper winds exceeding 80 kt at 500 mb; 100 kt at 400 mb; and 120 kt at 300 mb.

One of the greatest remaining problems in forecasting was the location and tracking of jet streams in the regions 15,000 to 40,000ft, which might give winds in a confined region, but over considerable distances, of up to 200 kt. Adequate facilities for air navigation at high altitudes were therefore most necessary.

CONGO POSTSCRIPT

FOLLOWING upon our recent review of the early days of Sabena's Congo services and a description of their operations today, we have received an account of the experiences of a Continental journalist, M. Jean-Paul Darmsteter, who has also visited the Belgian Congo recently. The following are extracts from an article he has written, entitled *The Magnificent Growth of Aviation in the Belgian Congo*; it covers the more popular side of Colonial services.

The character of air transport in Africa, says M. Darmsteter, differs profoundly from air travel in Europe. In the Belgian Congo aircraft have become a necessity and the lines are essentially operated as a public utility. Air routes are welding together the great centres of the Congo. For the people living in the interior the days of eating out of tins and existing on meagre local products are gone, and the carriage of fresh provisions by air is undoubtedly a most important aspect of commercial aviation in the Congo. There are many mixed-cargo flights carrying both freight and provisions, and movable seats permit of loading which always allows the maximum to be carried. The less favoured regions regularly receive vegetables, butter, fruit and meat. Costermansville, for example, distributes its strawberries over a range of 1,000 kilometres, particularly in the Katanga area, and mail, medicine, currency, books, journals, films and even oysters from Ostend and Swiss Camembert cheese are carried by air.

Aviation has also permitted the exploitation of the inexhaustible treasures of Africa—coffee, oil, copper, zinc, gold, diamonds, wood, and, not least, uranium.

Thanks to the helicopter, which has now begun insectidal operations on a large scale, contaminated regions are now becoming more and more rare and will soon have disappeared completely.

While the black population of the Congo exceeded 11 million a year ago, the other races amounted to only 53,176. On its African network alone, Sabena carried 29,271 passengers during 1950, and thus it can be seen that more than half of the Congo's white population used aircraft as a means of transport. The Congo is a paradise for aviation, but aviation pays it back in full.

On the subject of navigation and meteorology, M. Darmsteter says that until recently magnetic anomalies have not permitted the drawing-up of precise maps upon which correct variation lines are shown for all regions, and this situation, though temporary, represents a serious inconvenience to private aviation, whose navigators rely on dead reckoning. Airlines, however, can enjoy an extensive network of radio beacons. The administration established by the Service de l'Aeronautique undertakes the building and maintenance of landing grounds and a network of radio stations and radio beacons. It also looks after the dissemination of meteorological information. The radio beacons are worked only on demand from aircraft, but their network, which already carries a large portion of the territory in the Belgian Congo and the Ruanda Urundi, will continue to be expanded. In addition to established broadcasts from a scattered network of meteorological stations, pilots and navigators rely particularly on weather "actuals," which are transmitted regularly.

At the Equator, the seasons are not clearly defined, and the weather is uniformly inclined to thunderstorms—which is not to say that it will not include exceptionally fine days. Cu-nim clouds are particularly dangerous, but fortunately they are isolated and can be circumnavigated. Should an aircraft encounter a continuous chain of violent storms, known as a line squall, its crew can be sure of a particularly difficult passage, and might be wiser to turn back. But even in these conditions Sabena has achieved magnificent regularity on its African routes, which goes to show that weather conditions do not constitute a handicap to the development of aerial navigation if they are fully appreciated. It is simply a matter of adhering strictly to the essential precautions.

THE INDEPENDENT AIR OPERATOR

A Short History of the "Associate Agreement" Era: Building for the Future

By DAVID JOHNS

NOW that the election of a new Government presages a happier relationship between Britain's air-transport operators and the State Corporations, this review of the past three and a half years of commercial aviation in and around these islands under "Associate Agreements" is of value for the record; secondly, it defines the starting-point—the relevant sections of the Civil Aviation Act as they stand today—from which any changes will be made; and, thirdly, it indicates how the experience which the independents have been accumulating on "Associate" routes will fit them for any new and greater responsibilities they may be given. The author has had a close professional connection with the two sides of the subject concerned.

WHEN, in June 1948, Lord Pakenham succeeded Lord Nathan at the Ministry of Civil Aviation he found that outstanding among the various problems awaiting his attention was the necessity of providing air transport in areas not served by the Corporations. He decided that an investigation should be made into the whole problem in the light of the Civil Aviation Act as it then stood—especially with a view to the operation of routes by private operators, who were then restricted entirely to charter work.

The Minister asked Marshal of the Royal Air Force Lord Douglas of Kirtleside to undertake the investigation. Although the findings, which became known as the Douglas Report, were never published, the Minister decided—perhaps as a result—that further scheduled operations by private operators were necessary; on January 29th, 1949, he made a statement in the House of Lords that such firms would be allowed to fly scheduled services in areas not served by the Corporations.

In his statement Lord Pakenham pointed out that, under the Civil Aviation Act, the services operating out of this country were reserved for the Corporations and their "Associates"; therefore, in accordance with the Act, it would be necessary for the independent operator wishing to provide air services to become an Associate of the Corporation whose sphere of influence was affected. He stated that as several operators might apply for the same route, the services of an independent body would be required to advise him which company or companies should operate, and he had therefore asked the Air Transport Advisory Council, under the chairmanship of Lord Terrington, to undertake the task. In conclusion, the Minister pointed out that although the Council would consider each application and make its recommendations, the final decision would rest with him; therefore, to assist and to guide it along the lines of Government policy, he would issue a directive.

This directive to the Council pointed out that when services were recommended consideration should be given to the cost of supplying ground and navigational facilities, and that, if such additional expenditure seemed necessary, recommendation of the route should be avoided. He also laid down that the Council should have the right to fix the maximum and minimum fares to be charged, but that in general the fares should not be less than those charged by the Corporations, except by agreement with them. Provision was also made for the submission of applications to the Corporations for comment, and also that any company granted permission to operate should not employ its staff on terms less favourable than those offered to the employees of the Corporations. Finally, the Council was directed not to recommend the granting of an Associate Agreement for more than two years at a time.

Another class of independent operation, not dealt with in this article, is charter work. Among firms engaged in it is the Hunting organization, one of whose Bristol Freighters—operated by Hunting Aerosurveys, Ltd.—is seen waiting to receive a bulky cargo.

The Air Transport Advisory Council was constituted in accordance with Section 26 (i) of the Civil Aviation Act, 1946, and the Civil Aviation (Air Transport Advisory Council) Order 1947; it was to consider, firstly, any representations from the public about the facilities provided by the three Corporations and the charges made for them and, secondly, any questions concerning air transport which the Minister might refer. It was, therefore, under this second category that his decision was made.

The Council consisted of a chairman, four members and a secretary. Later, in view of the new commitments, it became necessary to appoint an assessor. Faced with a new, difficult and far from enviable task, the Council called for applications; and in 1949 it received 231. During that year it held some 17 meetings to consider the applications and also received deputations from various regional bodies, from the British Air Charter Association and from B.E.A. The Corporation was asked to submit its comments, and the views of the four Advisory Councils from Scotland, Ulster, Wales and the Channel Islands, as well as of the British Transport Commissions, were sought.

As a result of their efforts in 1949, the Council recommended 59 ordinary scheduled services and 26 "inclusive tours." The balance of applications were rejected on the grounds that (a) the service was in direct competition with the Corporations, (b) the company lacked operating experience, (c) the route had already been allocated to another company, (d) the route involved a breach of the Anglo/Eire agreement and/or (e) the places to be served had inadequate ground and navigational facilities and that their provision would have involved extra national expenditure.

Of the applications forwarded, the Minister rejected two; one concerned an international service which, he felt, involved questions beyond the Council's competence, and the other dealt with the operation of a service by Scottish Aviation, Ltd., from Aberdeen to Belfast *via* Perth and Prestwick; this latter application was opposed on the grounds that the Prestwick-Belfast sector directly competed with the Corporation's own Renfrew-Belfast service, but as a compromise it was suggested that Scottish Aviation could operate from Aberdeen to Renfrew *via* Perth, to connect with the B.E.A. service to Renfrew. The Council, however, did not agree with this view and recommended that the company be granted the traffic rights over the whole route. After due consideration the Minister exercised his prerogative and upheld the Corporation's view. Scottish Aviation did not operate the sectors granted them.

The Minister, evidently satisfied with the results of the operations, extended the scheme into 1950; again the Council called for applications, and this time they received 177. After 15 meetings had been held, 96 applications were

recommended, comprising 80 ordinary scheduled services and 16 inclusive tours, nearly all of which were for periods of one year only. The balance were rejected on similar grounds to those of 1949. On this occasion two routes to the Channel Islands, previously operated by independent operators, were opposed on the grounds that the Corporation intended to take over the routes. The objection was sustained. The Minister failed to agree with the Council's decision on four occasions; three concerned international routes and the other a service between Liverpool and the Channel Islands.

During 1950 the operators voiced dissatisfaction over the period of operation granted them by their agreements. It was argued that, as most of their equipment was ageing, they should know where they stood concerning their routes, in order that they might plan for the introduction of new aircraft if necessary. One company claimed to have lost its chief money-making route, and had found itself with a large outlay for new aircraft on its hands and with little chance of redeeming it with the route still available. This occurrence, no doubt, had a sobering effect on the others; but it stimulated the British Air Charter Association to make representations to the Minister asking for the granting of traffic rights for longer periods, and B.E.A. suggested that five years might be acceptable to the Minister. When Lord Pakenham had consulted B.E.A. it was decided that Associate Agreements could be made for this length of time, and eventually a statement was made in Parliament to this effect. The Minister then altered his directive to the Air Transport Advisory Council to allow for this extension, and when the Council invited the companies to submit their applications for the 1951 period some 151 requests were received.

Before leaving the subject of the Air Transport Advisory Council, I think it is only fair to comment that the body has retained its independence and, whilst giving full and unbiased consideration to all applications and representations made to it, has not hesitated to make recommendations which in its opinion are to the public benefit, even if these recommendations clash with the feelings of the Corporation and other interested bodies. It is also interesting to assess the Council's work in the light of the similar duties undertaken by America's C.A.B.: one notes that in many respects the small operator in the United Kingdom is in a relatively better position than his American counterpart, who is discouraged from operating any scheduled services in competition with the major privately owned U.S. carriers; the latter frequently engage in long legal arguments before the C.A.B. when decisions have to be made as who shall operate such and such a route.

B.E.A. and the Five-year Plan

When the Minister had decided that Associate Agreements could be extended to cover a five-year period, the Corporation carefully studied its own position over that period and had decided just how much further expansion was possible with its existing fleet, and with any further planned replacements, until the day the large helicopter made further development possible. With this picture clearly in mind, Lord Douglas, chairman of B.E.A., decided to invite the independent operators to meet him in order that he might hear their proposals and be able to advise them whether or not the Corporation would raise any objections to their proposed operations. Three such meetings were in fact held and, as a result, most of the operators knew where they stood; in fact some of them were able to persuade the Corporation to modify its views. Later B.E.A. invited certain companies to apply for Associate Agreements to operate in parallel with the Corporation's London-Southampton-Channel Islands routes during the peak Saturdays of the season. Morton Air Services, Ltd., and Olley Air Service, Ltd., were successful applicants for the flights out of London, and Aquila Airways, Ltd., and Airlines (Jersey), Ltd., shared the route from Southampton.

The Independent Network.—To study the network of services provided by the independent operators, we may divide the country into five areas—Scotland, the Isle of Man, and North, West and Southern England.

From Scotland, Scottish Aviation, Ltd., operate services from their base at Prestwick to the Isle of Man, and to

As well as carrying passengers and cars on their Channel ferry under a B.E.A. Associate Agreement, Silver City Airways also carry goods under charter. Here one of their Freighters is seen receiving a Hiller 360 crop-spray helicopter, to be flown to the Sudan for Pest Control, Ltd.

London *via* the American airfield at Burtonwood. The service to the Isle of Man is seasonal but the demand is heavy in the summer. The company has the rights over this route for five years.

The latter Scottish Aviation route—Prestwick/Burtonwood/London—is interesting, as it came into being after long negotiation between the company and B.E.A. The Corporation held that the trunk routes out of London were their own responsibility, but eventually the Scottish proposal was approved on the understanding that the Agreement would be valid for one year only, as an experiment to meet U.S. Service requirements between Prestwick, Burtonwood and Northolt. The service now operates every week-day, leaving Prestwick shortly after 0800hr and, despite the call at Burtonwood, gets its passengers to Northolt in the mid-morning. Members of the general public are also carried and this allows both Scottish and Northern businessmen to do a good day's work in the South before returning in the evening. The company uses DC-3s and provides catering in both directions, but there is no inclusive surface transport between city centre and airport; this is a new feature and one which will be applied when B.E.A. introduce their low-fare Paris services; but, nevertheless, it does not appear to have had any adverse effect on bookings.

Scottish Aviation also received permission to operate the long-disputed route from Aberdeen to Belfast *via* Perth and Prestwick, but up to the time of writing they have not put this into effect.

The Isle of Man, being one of the main holiday centres for the North, naturally provides big opportunities for the independent operator. The two chief independent operators in this area were North West Airlines (I.o.M.), Ltd., and Lancashire Aircraft Corporation, Ltd. The former company obtained agreements for a period of two years when first applying to the A.T.A.C. in 1949 but toward the close of the period threatened to suspend these services unless a longer period of operation was granted. The company's case was that, in the time available, it could not offset the expenditure which it had incurred by the purchase of DC-3s. The threat caused a great deal of concern in the Isle of Man but the crisis was averted by the pooling of the resources of the two operators concerned. The routes covered by these companies are from the Isle of Man to Leeds, Blackpool and Newcastle. North West Airlines previously operated to Manchester, Renfrew and Birmingham, but this year they discontinued the last two runs. The Manchester route, which the company shared with Sivewright Airways, Ltd., has been taken over by B.E.A. Beside the routes mentioned, Lancashire Aircraft Corporation now also operates between the Isle of Man and Carlisle and Newcastle and the Channel Islands. Last year they flew a number of feeder services from the northern cities into Northolt, providing connections with the B.E.A. services to the Continent. Universal ticketing and documentation between the company and the Corporation was agreed and a "public facility" was therefore provided, allowing the

THE INDEPENDENT AIR OPERATOR...

North Country businessmen to visit the nearer Continental cities and return in the same day. These services, however, were discontinued at the end of the 1950 season and were not re-established this year; the company gave as its reason that the period of operation granted was not long enough—but, as the loads carried on these surfaces, with the exception of the Manchester route, were not heavy, economy would appear to be an important factor. I feel it necessary to stress here that on most occasions the fares on these routes were high—in fact, too high in comparison with the Continental fares, one example being £12 return (later raised to £14) between London and Newcastle. There is no doubt that the high cost of petrol and landing fees, and the comparatively small aircraft used, were the cause. The London-Manchester route was re-opened this year by Melba Airways, Ltd., a company based at Ringway, but the route was discontinued and the company concentrated on its routes to Bournemouth, whence they branched to Sandown (Isle of Wight) and Jersey. Melba Airways also tried the route from London to Penzance, which had also been operated by L.A.C., but this route also was discontinued; and again I feel that, whilst there is a demand for such a service, it is the high fare which defeats the end. Also operating from Manchester is a service to Newquay by Finglands Airways, Ltd.

Turning westward and to Wales, a country formerly served comparatively poorly, by reason of its rugged landscape, we find Cardiff's Pengham Moors the centre of the activities of Cambrian Air Services, Ltd. This company operates from Cardiff to the Channel Islands, Weston-super-Mare and also to Liverpool. Traffic rights have been granted from Liverpool to the Channel Islands *via* Cardiff for five years and passenger traffic on these routes is heavy. The company provides one of the few year-round services offered by independent operators.

Across the Severn, at Bristol's Whitchurch Airport, Morton Air Services, Ltd., are well established. Originally operating to the Isles of Wight and Man, the company dropped these routes at the close of the 1950 season and concentrated on the Channel Islands, with outstanding success. This is another year-round service, and in the summer the small aircraft operate at fairly high frequency, while in winter the company is able to handle the small but useful demand with the same equipment, whereas an operator of large aircraft would be embarrassed by the small loads. Mortons have the rights of this route until the end of 1952.

Murray Chown Aviation, Ltd., a comparatively new company based at Staverton Airfield, near Cheltenham, operate in South-West England. Their line runs from Staverton to Newquay (Perranporth), whence regular services are flown to Land's End and the Scilly Isles. Another route is flown from Staverton to the Channel Islands *via* Hurn, near Bournemouth. All these routes have five-year Agreements, and useful seasonal loads should be carried.

Turning to Southern England, the independent operators (apart from Melba Airways, already mentioned) are concentrated in the south-east area. The foremost of these is East Anglian Flying Services, Ltd., who are based at Southend Municipal Airport. This company has a five-year Agreement for the route from Southend to Jersey and flights from Southend to Ostend are also scheduled. East Anglian are in the happy position of being the only operators in the area and, as the coach connections to Southend are excellent, their passengers may be drawn from towns as far away as Chelmsford and Colchester.

A specialized type of passenger carriage is the "leave" service operated by Airwork, Ltd., for military and civil organizations overseas. Vikings are employed.

Further along the coast, at Lympne, there is the most revolutionary of all British air-transport operations, namely the car ferry service of Silver City Airways, which operates across the Channel to Le Touquet. The company started this ferry as a modest side-line, but it has become so popular that the fleet has been increased to eight Bristol Freighters (with six more, of a new "long-hold" type, on order), and it was recently reported that the company now carries an eighth of the total cross-Channel car traffic. This agreement is valid for ten years, and an application has been approved for the operation of a similar service between Southampton and Cherbourg. Also situated at Lympne is Air Kruise (Kent), Ltd., who operate a thrice-daily passenger service to Le Touquet with Rapides.

Whilst the majority of operations discussed here involve short-haul or ferry flights, the route-mileage flown by Aquila Airways, Ltd., is in the long-haul category. The company, which is based at Hamble, Southampton, operate Solent and Hythe flyng-boats and their line extends from Southampton to Madeira and thence to Lisbon and the Canary Isles. The flying-boats provide Madeira with its only possible air communication as the confined rocky terrain makes landplane activities impossible. Aquila are the only independent operators flying as Associates of B.O.A.C. They have several mail contracts and also interline arrangements with various major international carriers, thereby providing through travel facilities to most countries of the world.

This, then, is the story of the independent operator in post-war aviation to date. With a new Government now at Westminster, it is difficult to formulate a detailed picture of the future; but, whatever new demands are made upon these companies, the experience gained in the last few years will stand them in good stead.

TOWER BRIDGE FLIGHT SEQUEL

THE sequel to the flight through Tower Bridge by a pilot of a light aircraft was heard at Mansion House on December 21st, when Frank Miller, a 39-year-old chemist of Chingford, Essex, was fined £100.

He appeared in answer to a summons alleging that, on Sunday, November 25th, he was "in command of an aircraft which failed to comply with Rule 14 (2) of Section III of Schedule II of the Air Navigation Order of 1949 by flying over London at an altitude of less than 1,000 ft above the highest obstacle within a radius of 2,000 ft from the aircraft." (The maximum penalty under this section is £200 or six months' imprisonment, or both.)

The defendant (who had hired the aircraft from the Denham Flying Club and had his 13-year-old son with him as a passenger) pleaded guilty to the charge.

Mr. C. J. Thackery, for the police, said that the space [between the upper and lower spans of the bridge] through which the machine flew was 106 ft 8 in high and 226 ft wide. A sudden gust of wind might well have proved disastrous.

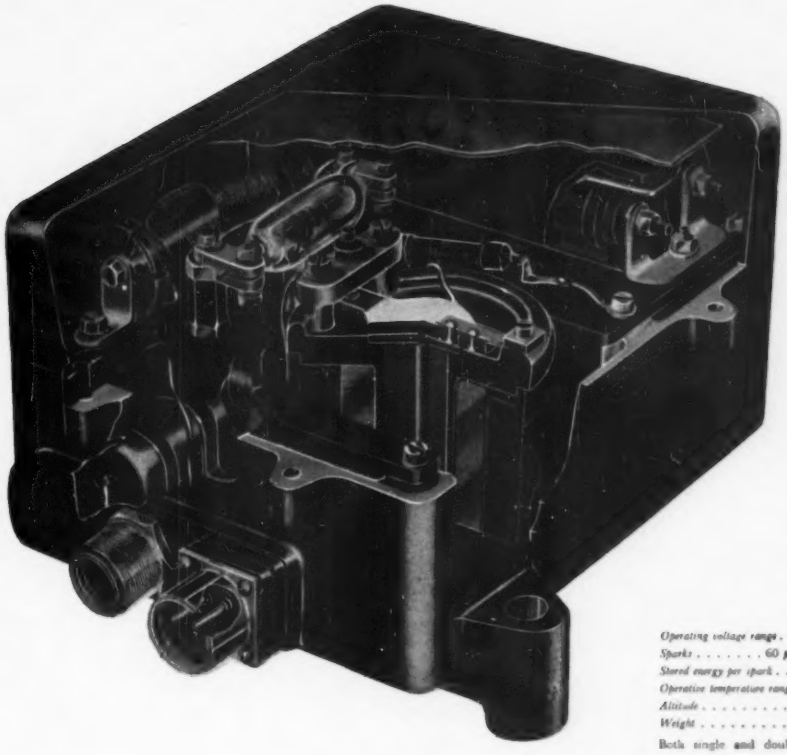
Miller: "There were no gusts of wind and no shipping on the river, and nothing approaching the bridge. As regards engine trouble, I have never known a plane maintained by the Denham Club have engine failure."

The Clerk asked Mr. Thackery whether the Court had any power to endorse a flying licence.

Mr. Thackery said he did not know, but he did not think so. There was provision for the Minister of Civil Aviation to place a limitation on a flying licence and he imagined that such action would be taken in that quarter. The limitation might, for example, bar Miller from flying over any town. His present licence expired on December 28th and he thought that any necessary action would be taken if a renewal were sought.

In imposing the fine, the Magistrate (Ald. Sir Frank Newson-Smith) told the defendant: "It is easy for you to say there was no danger. You seem to forget that there were pedestrians and traffic crossing Tower Bridge—probably horses as well—and you were not in a position to calculate possible dangers."

Although the aircraft was described in Press reports as an Auster it was, in fact, a Plus D Taylorcraft, G-AHBO.



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BOUNDARY-LAYER CONTROL

Some Basic Considerations: Methods of Research and Results Achieved

By A. G. THOMSON

THIS simply expressed, succinct review of boundary-layer control should be helpful to all those who have but a nodding acquaintance with the subject. Today, interest in this branch of aerodynamics is considerable, for it has long held out the tantalizing promise of reducing drag and/or increasing lift: until the gas turbine arrived, however, there was not much hope for the practical employment of this attractive system.

THE conception of a thin "boundary layer" surrounding the wing of an aircraft in flight was first put forward in 1904. Even at that early stage in the history of aviation it was realized that the layer could be controlled by withdrawing it through a slot, thereby preventing its separation from the surface. It was later established that, at a certain position depending on various factors, the airflow within the boundary layer ceased to be laminar in character and changed to a state of turbulence which resulted in increased drag. This change is called "transition."

Various attempts have been made to reduce the drag or increase the lift of a wing by removing the whole or part of the boundary layer before transition or separation could occur. By the outbreak of the Second World War a number of experiments had been made, but without very much success; for the most part, research was confined to sucking the boundary layer through slots cut in various positions on already existing aerofoils.

By 1944 methods had been developed for designing wing sections to have any specified pressure-distribution, and this led to a revival of interest in the possibility of controlling the boundary layer. It was known at that time that neither boundary-layer transition nor boundary-layer separation (or break-away) was very liable to occur if the pressure was decreasing in the direction of the flow. A logical step forward, therefore, was for further studies to be carried out on wing sections so designed that the pressure tended to fall in the direction of the flow for the maximum possible distance, with the result that the boundary layer remained laminar for as long as possible.

The methods of aerofoil design which had opened up these new possibilities for reducing drag were developed at the National Physical Laboratory by Prof. S. Goldstein. It was natural, therefore, that the Aerodynamics Division of the N.P.L. should be asked to undertake further investigations on the effectiveness of boundary-layer suction as a means of improving the low-drag properties of aircraft wings. The procedure adopted was to design sections with suitable pressure distributions and test them in wind tunnels.

Dr. A. A. Griffith suggested that, since it was impossible for the fall in pressure to be maintained throughout the entire length of the section, attention might be accorded to the feasibility of letting it continue to some chosen far-back position, and then have a sudden discontinuous rise, succeeded by another continual fall. When a section is designed on this basis the shape of the aerofoil becomes rather like that of a tadpole.

Since the introduction of an abrupt pressure-rise renders the boundary layer even more liable to break away at that point, it is necessary to withdraw some or all of it by suction through a slot, or, alternatively, to blow air out parallel to the surface and so re-energize the boundary layer. Both methods have been tried, but so far most work has been done on suction, though there is still a possibility that blowing might give better results in certain practical applications. Greater attention has hitherto been devoted to suction, because preliminary investigations suggested that the quantity requirements were likely to be rather less than for blowing. On the other hand, the possibility that it may be easier to blow has not been overlooked. At this stage the comparative advantages of the two methods cannot be finally assessed.

Expediency

The investigators have tested several sections designed on the principle of the sudden discontinuous rise, the results obtained being in reasonable agreement with the theoretical predictions. The practical possibilities of this development appear to be governed largely by economic factors, the most important consideration being the amount of power required to propel an aircraft. If the wing sections are of the special suction-type, the power normally required to overcome the effects of external drag is very greatly reduced; but, on the other hand, this saving is to some extent offset by the power necessary to provide the suction.

The investigators find that the added complication of suction is more likely to be justified in the case of thick wings, which offer structural advantages as well as other important gains such as increased storage capacity. The first aerofoil tested was 16 per cent thick, but, when it was realized that greater gains might be expected from thicker wings, it was decided to carry out further studies with a 30 per cent section. In common with the previous sections this was constructed with two slots located respectively on the lower and upper surface, but at this point the designers suggested that there should be only one suction slot. The next wing, known as the GLAS II (Fig. 1), was therefore designed with a single slot on the upper surface. This design has been taken up in Australia, where test flights have been carried out on a glider fitted with wings of this type. Certain difficulties were experienced, but these can be overcome, and the performance of the glider is already very satisfactory.

Another method of sucking-in the boundary layer is to

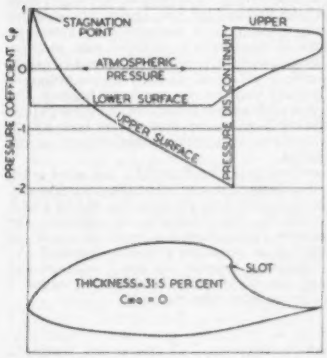


Fig. 1. GLAS II aerofoil section with theoretical pressure distribution at zero lift.

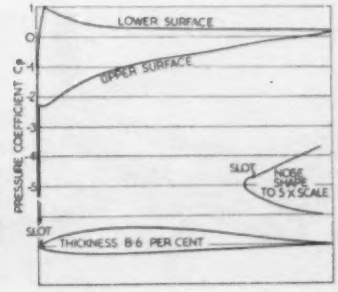


Fig. 2. Gleuert nose-slot aerofoil with curves of theoretical pressure distribution at 10 deg incidence.

BOUNDARY-LAYER CONTROL . . .

have the suction distributed over a relatively wide area of porous material instead of being effected through a localized slot. This system promises to be quite economical in suction quantities and does not necessarily require the wing section to be specially designed. Much theoretical research on this type of aerofoil has been done at the N.P.L. and has been followed by experimental work at Cambridge University, both in a wind tunnel and in flight.

In all wings where the boundary-layer transition occurs a long way back the benefits gained will be lost if the airflow is allowed to become turbulent through such causes as deposited insects, dust, or surface roughness. Insects are invariably collected at the leading edge, which, from the point of view of increased drag, is the worst possible place for interference with the boundary layer. Various methods for dealing with this problem have been considered. None can be said to have reached a really satisfactory stage, though some show promise of being commercially practicable.

A method which has been tested at the N.P.L. is to suck in the boundary layer just behind the rearmost point at which flies and dirt are deposited (Fig. 2). Since the quantity requirements are fairly large, the designer cannot afford to place the suction slot any farther back than is absolutely necessary. Another very well-known method, developed at the R.A.E., is to cover the front of the wing with an expendable cover, which is jettisoned once an insect-free altitude has been reached.

Attention has also been devoted to the possibility of controlling the boundary layer in order to increase the maximum lift of a thin section. It had long been known that the stall was due to separation of the boundary layer from the upper surface in the region where the pressure was rising very rapidly, just behind the leading edge. When the new methods of aerofoil design became available, it was decided to investigate the advantages which should theoretically result from wing sections so designed that the pressure-rise was less severe.

The method adopted at the N.P.L. was to concentrate most of the rise in pressure at a single point in the wing section, the pressure being allowed to rise discontinuously at this point, so that the rate of rise over the rest of the surface was sufficiently gentle not to cause boundary-layer separation. At this position of discontinuous rise it was necessary to suck-away the boundary layer through a slot.

The investigators have tested several sections designed on these lines, with results which agree fairly well with theory. The extent to which the principle is likely to be applied in practice depends primarily on the amount of boundary layer which can be withdrawn, coupled with the power required for suction.

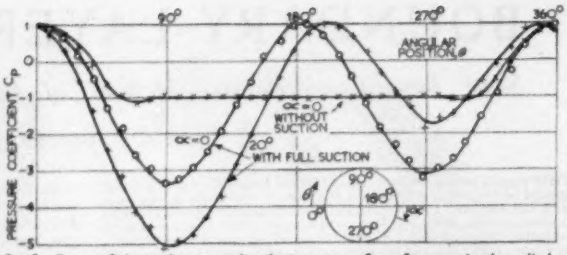


Fig. 3. Curves of observed pressure-distribution over surface of porous circular cylinder with Thwaites flap.

Another way of achieving boundary-layer separation from the nose of an aerofoil at high lift is the method referred to earlier, namely, to make the surface porous and suck air through it. This method also has been tested in tunnels at the N.P.L., the results obtained suggesting that it requires smaller suction quantities than for slot suction, though a disadvantage is that the internal suction head which has to be provided is liable to be rather greater. As yet, it is impossible for any general statement to be made regarding the relative power requirements of the two methods.

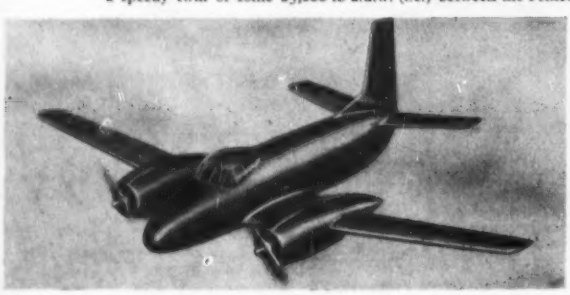
In general, lift is obtained by increasing the angle of incidence of a wing, but from time to time methods have been put forward for obtaining lift independently of incidence. A very novel way was proposed by B. Thwaites, who suggested that, by choosing a wing section with a rounded trailing edge, a close approximation to theoretical flow might be obtained. The lift on the aerofoil might then be determined by a small flap—which must be perpendicular to the surface—fitted at the rear of the aerofoil to determine the direction in which the flow leaves the trailing edge.

This proposed method has been tried experimentally and found to work. The experiments were conducted with a cylinder provided with a radial flap which could be moved round to any desired position (Fig. 3). This was a particularly severe test, but the case was a simple one to examine theoretically. The results confirmed the theoretical prediction that lift was developed, the magnitude of the lift being in reasonable agreement with what might be expected.

Many practical problems are involved in the attempts which are being made to obtain, by suitable boundary-layer control, higher lift from thin sections and reduced drag from thick sections. The success of these researches, however, would provide such outstanding economic gains that continued perseverance is regarded as well worth while.

THE BEECHCRAFT T-36

AN aircraft which seems likely to assume considerable importance in the next year or two is the Beech T-36, described as an advanced trainer-transport. Its specification cannot be compared directly with that of any current British design, but it may be said to come in the line of the Prince-Valetta-Varsity. It is a speedy twin of some 25,000 lb a.u.w. (i.e., between the Prince and Valetta) and is powered by two Pratt and Whitney R-2800s with a take-off rating of 2,300 b.h.p. The span of 70ft is less than on the Valetta (89ft 3in) and Varsity (95ft 7in), and its 12-passenger capacity as a transport with two crew is distinctly low. However, high performance seems to have been a principal aim, and the cruising speed of 300 m.p.h. and the probable top speed of nearly 350 m.p.h., together with a ceiling of 34,000ft and a radius of action of 650 miles, indicate that the aim has been realized. As a crew or pilot trainer, it would carry an instructor and three pupils.

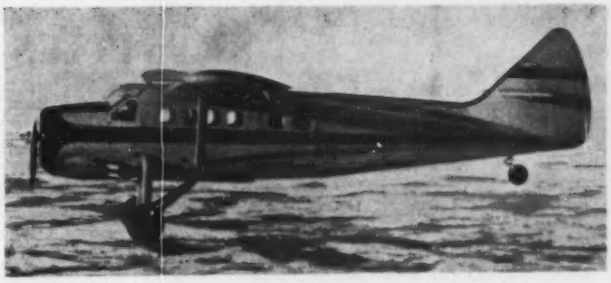


Beech Aircraft Corporation's latest, the T-36 trainer and transport.

Substantial orders for the T-36 are reported to have been placed with Canadair, Ltd., Montreal, in addition to those given to the parent company at Wichita.

Beechcraft, whose earlier twin, the Expediter did good work on communication duties during the war (the trainer version was known as the Navigator), continue to produce the Model D18S with two 450 h.p. P. and W. Wasp Juniors. In addition, the company is now in process of completing a batch of 100 Twin Bonanzas. This aircraft is an attractive post-war-designed six-seater with 260 h.p. Lycoming engines. It has a conventional fin and rudder, although the single-engined Bonanza, to which it is related, employs the butterfly configuration.

CIVIL AVIATION



FIRST TIME UP: Photographed while on its first flight last month is the prototype DHC 3 Otter—an enlarged version of the well-tried Beaver which is now giving valuable service in many countries. A description of the machine appears on this page.

B.C.P.A. ORDER COMETS

IT has been known for some time that B.C.P.A. have been investigating the possibility of using long-range Comets on their trans-Pacific services and, as we go to press, there is news of the approval by the Governments of the United Kingdom, Australia and New Zealand of an order for six Series II (Avon-powered) machines. De Havillands have stated that although the actual contract has not yet been signed, the order is a firm one; it will involve a capital outlay by B.C.P.A. of some £3,000,000, exclusive of spares. A delivery date in 1954/55 has been mentioned. The aircraft, which will probably be 44-seaters, will be used on routes linking Sydney and Auckland with San Francisco and Vancouver by way of Fiji, Canton Island and Honolulu.

B.C.P.A. is jointly owned by A.N.A. (Australia), N.Z.N.A.C. (New Zealand) and the United Kingdom.

Meanwhile, the preparation of Series I Comets for B.O.A.C. is proceeding according to schedule and in spite of the conditions prevailing in Egypt no alteration of plans has been announced for the introduction of Comets on services to South Africa. It has been intimated, however, that for a number of reasons these flights may not be started until mid-spring. The first route for the Comet is still likely to be *via* Cairo, Khartoum, Entebbe and Livingstone to Johannesburg and, if sufficient aircraft can be delivered, it may be possible to begin services to Singapore towards the end of the year. It is also possible that, if enough are available, Comets may be introduced on the New York to Nassau and New York to Bermuda services in about 18 months' time. The sixth Comet I flew on New Year's Eve.

So far as the Series IIs are concerned, both the Corporation and the manufacturers are understood to be optimistic about the possibility of using them on North-Atlantic services considerably sooner than certain foreign critics have estimated. It has been suggested, in fact, that recent predictions regarding the time it will take to develop the machines for North-Atlantic work may prove to have exaggerated by as much as two years.

THE D.H. OTTER FLIES

THE prototype DHC-3 King Beaver, now renamed Otter, made its first flight on December 12th in the hands of Mr. George Neal, chief test pilot of D.H. (Canada), Ltd. The first public demonstration of the aircraft is due to take place shortly at the company's Downsview Airport.

The Otter (a cabin-layout diagram of which appeared in *Flight* of August 24th last) has been designed to fill a definite requirement for a larger version of the Beaver, the formula for which has been found in extensive operations to be highly satisfactory. Accordingly, the Otter has almost double the payload capacity of the Beaver, with comparable performance. It is powered by a Pratt and Whitney Wasp H-R 1340 developing 600 h.p., as compared with the Beaver's 450 h.p. engine. The Otter will thus show a considerable improvement in operating economy when undertaking the same class of work as that of the Beaver.

The payload of the landplane version (at a provisional gross weight of 7,200 lb) with 500 miles range will be 2,175 lb. Take-off distance to 50ft at full gross load will be about 1,000ft and the initial rate of climb 1,050 ft/min.

For a single-engined aircraft the cabin is exceptionally roomy; various layouts provide seating accommodation for from eight to fourteen passengers. An ambulance version will take six standard-size military stretchers plus four seated passengers and a crew of two. In all cases seating is arranged forward of the 39 cu ft stowage compartment located at the rear of the cabin. The dimensions of the cabin are 5ft high by 5ft wide with a 46in-wide access door on the port side to permit the loading of bulky freight

The Otter is built entirely of metal and can be operated on either wheels, floats or skis. Cruising speed is in the region of 145 m.p.h. and the fuel capacity of 228 U.S. gallons will give a maximum still-air range of 956 n.m. A photograph appears above.

C.A.T. LOSES ITS CASE

LAST week the Supreme Court of Hong Kong dismissed the appeal brought by the American company, Civil Air Transport, against the Court's decision that 44 aircraft (now grounded at Kai Tak and formerly the property of the Nationalist-controlled Central Air Transport Corporation) belonged to the Central People's Government which was established at Peking on October 1st, 1949. Under an earlier action C.A.T. had claimed ownership by right of purchase from the Nationalist Government.

In a written judgement, the president of the Supreme Court said that, by reason of its nature and the surrounding circumstances, he did not consider this transaction vested in the company a good title of ownership as against the claim of Central People's Government. The sale of the aircraft by the Nationalist Government to C.A.T. was described as a device by which it was hoped to prevent the aircraft from passing into Communist hands.

C.A.T.'s president, Mr. Whiting Willauer, has announced his intention of appealing to the Privy Council but has stated that he will have further consultations with legal advisers before a final decision to do so is taken.

INCIDENTAL RUNNING COSTS

AFTER ten days of strike action, flying personnel of Air France finally agreed to resume their duties last Monday. The strike was one of the most serious which has yet taken place in Europe and is estimated to have caused a loss to the company of about £500,000. Nearly all Air France flights (except those of national importance) were grounded and many thousands of passengers were delayed or stranded at French airports. The strike order, which was issued when the company failed to grant salary increases ranging up to 66 per cent, was fully obeyed by all aircrews.

Although there is no news of a settlement at the time of going to press, it is understood that the Minister of Transport is to investigate the matter personally.

In South America, also, a widespread airline strike has virtually paralysed the country's air communications. In this case, however, the country's government decided to take firm action to meet the situation. When the strike had reached its fifth day the President of Brazil ordered the appropriation of all aircraft, company installations and fuel and, in addition, conscripted all strikers who, it was announced, would become subject to military law if they refused to work. The Air Force was ordered to stand by to operate aircraft for which the crews had not reported for duty and services gradually resumed their normal frequencies.

The fact that, when services did start up again, many of the machines flew practically empty was ascribed to the reluctance of most passengers to fly when the airlines were virtually operating under State-imposed duress. Brazilian trade unions described the Government's action as "manifestly unconstitutional."

COMPETING FOR ATLANTIC FREIGHT

TO meet the rapidly growing demand for fast all-freight services throughout the world in general, and on North-Atlantic routes in particular, two American companies took a bold step last week. Seaboard and Western Airlines, a well-known "non-sked" international freight carrier, announced an order for five L-1049B Constellations, the first commercial all-freight aircraft which Lockheeds have produced. These machines will augment—and, to a certain extent, replace—services now operated between the U.S. and points in Western Europe and the Middle East by the company's DC-4 freighters.

An even earlier improvement in North Atlantic freight capacity, however, has been provided by Pan-American Airways, who will introduce DC-6As—the first pressurized all-cargo transport—on their London to New York services. Much of the freight lifted by both of these companies will be of British origin, for to date no competitive long-range cargo machines of British manufacture are available for operators in this country.

CIVIL AVIATION . . .

BREVITIES

A RECENT announcement by the M.C.A. of the British Airways Corporation's traffic statistics for September indicates that more passenger-miles were flown than in any previous month. The total was 125,000,000, which was no less than 33 per cent greater than that for September, 1950. The total number of passengers carried was 181,000—a 24 per cent increase on the figure for the corresponding period of the previous year. B.O.A.C.'s revenue passenger load-factor in September was 73.7 per cent while B.E.A.'s figure was 76.4 per cent.

* * *

Australia's Director of Air Navigation, Mr. Stuart Campbell, has left to take up his duties as commercial-aviation adviser to the Government of Thailand. His post in the Australian Directorate of Civil Aviation goes to W/C J. H. Harper, who was formerly head of the aircraft investigation committee.

* * *

A new Brazilian air-survey company has been formed as an associate to a Toronto firm, the Photographic Survey Corporation Ltd., which is itself the Canadian associate of the Hunting Group of companies. To be known as Prospec, and based at Rio de Janeiro, the company will make available in Brazil all the services—including the supply of instruments and technicians—in which the P.S.C. now specializes in Canada.

* * *

The fact that the Wellington-Nelson (New Zealand) steamer passenger service is to be abandoned this year, because of high running costs, is expected to bring about considerable augmentation of the New Zealand National Airways Corporation's services between these two points. To accommodate the expected increase in traffic, the company will replace with 24-seat DC-3s the 15-seat Lodestars which are now used on this 45min crossing.

* * *

A draft outline of India's first five-year plan for her domestic airlines has been published. It contains, among other provisions, a stipulation that the aircraft operated on internal routes should be standardized. At the moment both Dakotas and Vikings are widely used and the authorities must soon reach a decision on suitable replacements. In the international field the plan envisages re-equipment with jet-powered airliners and, in fact, financial provision has been made for subsidizing such a venture.

Some idea of the regrettably small proportion of the world's aircraft manufacturing effort now being directed towards meeting civil requirements can be obtained from a recent statement issued by the Lockheed Aircraft Corporation. The company, one of the largest in the world, has announced a current backlog of $1,280,000,000, of which 89.6 per cent concerns purely military business. Only the remaining 10.4 per cent represents orders for civil machines.

* * *

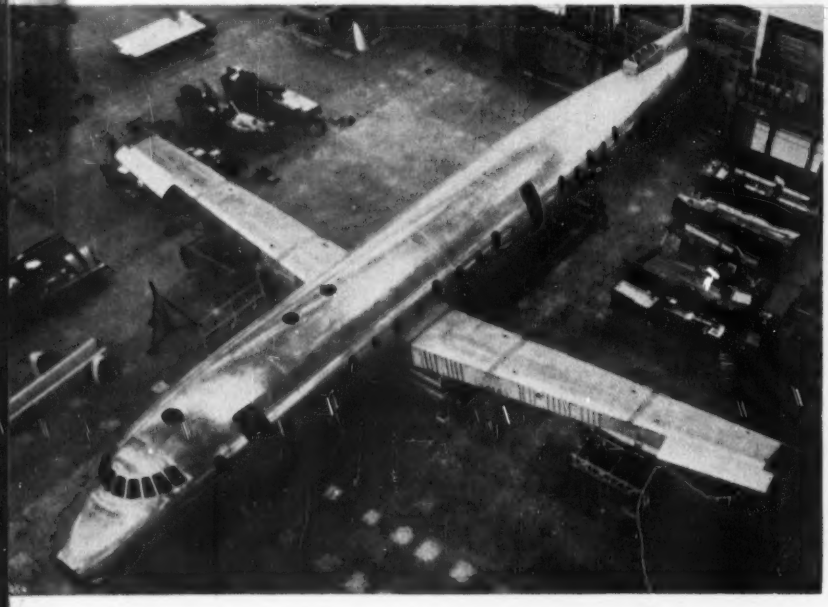
The official handbook entitled *Aviation Law for Applicants for the Private Pilot's Licence* (*M.C.A. P.* 85/1951) has been revised by the M.C.A. It now contains extracts from the U.K. *Air Pilot* and includes a map of the air-traffic control organization in this country. It brings together in convenient form those provisions of the Air Navigation Order and Regulations which are of particular concern to the private owner and club pilot. The booklet may be obtained from His Majesty's Stationery Office, and is priced at 1s 6d.

* * *

A record monthly turnover in international air traffic transactions put through the I.A.T.A. Clearing House in London was established during October. The turnover totalled $17,445,000, as compared with the previous record of $16,500,000, set up in September 1950. By offsetting the credit and debit balances of its members, the Clearing House eliminated the need for cash settlements on 89 per cent of the October total. In the cases of two airlines, offset ratios of 98.9 and 98.1 per cent were possible. The Clearing House is able to settle accounts in both dollars and sterling.

* * *

By the time the new tourist-fare services on the London-Paris route are in operation next October all B.E.A.'s 49 Vikings will have been modified to make them convertible at short notice into any one of five distinct seating versions. They can become 24-passenger luxury versions with reclining seats, hot-meal catering and a bar; 27-passenger hot-meal and bar; 34 cold meal and bar; a tourist version, carrying up to 38 passengers, to whom light refreshments only will be served; or a two-class version with 12 tourist seats in the front cabin and 15 reclining seats in the after cabin. All these versions will operate at the same basic weight.



B.O.A.C.'s NEXT

Encouraging evidence of progress with the Bristol 175 is provided by this photograph of the first prototype under construction. Since information was first released about this design there have been advances in the direction of greater economy and flexibility. With the latest mark of Proteus turboprop, performance and load figures are expected to be even better than were forecast, cruising speed being in the region of 360 m.p.h. B.O.A.C. are understood to be reviewing interior arrangements in the light of recent events, but so far a five-abreast 75-seat arrangement is foreseen as the "luxury" layout. The aircraft is spacious enough to carry over 100 passengers, so quick convertibility between four-, five-, and six-abreast seating is provided for. B.O.A.C.'s project engineer for the 175 is Mr. M. W. Anderson, who was previously associated with the development of the Corporation's Argonaut fleet.

CLUB NEWS

WITH the object of furthering the cause of private flying by closer co-operation between interested parties in both the United Kingdom and France, the A.B.A.C. has now become affiliated with the Fédération Nationale Aéronautique de France et d'Outre-Mer. Three of the main points from the Protocol will serve to illustrate the working of this interesting arrangement; they are (i) that the Federation and the Association shall make available to each other all information regarding their current activities and the measures effected in the interests of their member clubs by sending to each other copies of all notices, circulars and publications which are circulated; (ii) that both parties shall afford to each other any information or advice of a general or technical nature which may be considered helpful in the solution of current problems or otherwise affecting the flying club and air centre movement, and (iii) that the Federation and the Association shall request and encourage all their member clubs to extend honorary reciprocal membership to individual members of each others' clubs and shall each maintain and circulate a register of clubs which do this.

The protocol was signed in London on November 22nd, 1951.

THE Royal Aero Club has recently announced the introduction of a new 13-inch rule specially designed to be of greater assistance to the private pilot. Made of clear Perspex, this new instrument is marked in both four miles to the inch and 1 : 500,000 divisions, so that it may be used in conjunction with the flying maps most commonly in use. It also bears a kilometres/statute miles conversion scale. Costing 8s (plus 3d postage) it may be obtained from the Air Touring Department of the Royal Aero Club.

REPRESENTING a challenge to the high totals of flying hours recorded by various British flying clubs last year is an achievement by members of a more remote centre of aviation enthusiasm—the Royal Singapore Flying Club—where, during the first ten months of 1951, members logged nearly 2,000 hours.

NO AUSTERITY: This handsomely equipped Auster J 5D is owned by a keen private pilot, Mr. A. Mackenzie-Low of Hastings. With a view to all-weather usage and occasional "after sundown" sorties its owner has had it equipped with a considerably augmented instrument panel, cross-wind landing gear, a Plessey six-channel V.H.F. radio and a Harley landing lamp.

The average number of hours flown each month was 193, a figure which compared favourably with those of many of our own clubs. During September four days were set aside for the profitable *divertissement* of joy-riding, which incidentally helped to boost the number of hours flown during that particular month to 380 hr 45 min.

The R.S.F.C.'s fleet at present consists of three Tiger Moths, one Auster V and one Cessna 120, with the hope that another Auster V and Cessna 120 will be available in the not too distant future.

Preliminary steps are being taken with a view to holding an inter-club rally at Kuala Lumpur; the tentative date is the week-end January 19th-20th, 1952.

FORTY-EIGHT YEARS BACK

Some Notable Aviation Anniversaries: Recollections of the Early Certificate-holders

SOME notable aviation anniversaries have taken place during the past few weeks. For example, ten days ago—on December 17th—there occurred the forty-eighth anniversary of the world's first controlled, power-propelled, heavier-than-air flight—by the Wright brothers, Wilbur and Orville; and, no doubt, the golden jubilee of aviation will be suitably celebrated on a world-wide basis on December 17th, 1953.

The first Aviators' Certificates recognized by the F.A.I. were issued by the Aéro Club de France on December 4th, 1909. The Aero Club of the United Kingdom did not begin to issue such certificates until March 8th, 1910, when the first were issued to J. T. C. Moore-Brabazon and the Hon. C. S. Rolls, who were the first to apply. They made the applications simultaneously, so the certificates were issued in alphabetical order.

"Brab" and Charlie Rolls were close friends and did many things together. Moore-Brabazon—now Lord Brabazon of Tara—has long been famed as the holder of No. 1 Aviator's Certificate of the R.Ae.C., as proclaimed to the world by the registration number of his car—FLY 1.

Charlie Rolls, however, was actually the first Briton to be awarded an Aviator's Certificate, for he was given No. 23 in the list of the Aéro Club de France. Moore-Brabazon was awarded No. 40.

Among the first hundred of the Aéro Club de France are seven Britons, all of them very well-known in those early days. Following Rolls came Mortimer Singer (a member of the famous family who made fortunes from sewing machines, cycles, and motor cars) with No. 24. Claude Grahame-White qualified for No. 30, followed by Moore-Brabazon with No. 40. Then came Capt. Bertram Dickson, a British Army officer (No. 71) who was killed at a flying meeting at Milan in 1910 when he was piloting a Farman. (This was the first fatal air collision; the other aircraft involved was an Antoinette flown by M. Thomas of France.)

Certificate No. 72 was awarded to W. E. McArdle who, with an American, J. Armstrong Drexel (holder of R.Ae.C. No. 14), founded the New Forest School of Flying at Beaulieu, where the R.A.F. airfield is to-day. No. 75 went to Douglas Graham Gilmour, an enthusiastic young Scot who was an embarrassment to the committee of the R.Ae.C. by reason of his spectacular flying; eventually they suspended his certificate, so he was unable to compete in the 1911 Circuit of Britain Race.

The first 15 certificates of the Aéro Club de France were all issued on December 4th, 1909, and were consequently in alphabetical order, with Louis Blériot as No. 1 and Wilbur Wright No. 15. The Aéro Club de France said they were uncertain who were Nos. 1, 2, and 3 so they "hedged" and issued them in alphabetical order.

There can be little doubt that Orville Wright should have received No. 1, Wilbur No. 2, and Santos Dumont No. 3. But for a long time the French were unwilling to recognise the priority of the Wrights; and still they claim, with no justification, that Clément Ader flew in 1897—though a committee of French army officers, whom Ader had invited to witness his attempts to fly, publicly stated that Ader had not flown but had only been jolted off the ground with little help from his wings. The records show that Ader never made any appreciable hop and had no real control of his *avion*, even before take-off; the attempt ended with a wreck.

After Blériot's No. 1 came the American, Glen Curtiss with No. 2; Léon Delagrange, No. 3; Robert Esnault-Pelterie, who claimed the invention of the single-stick control-column, No. 4; Henri Farman, No. 5; Capitaine Ferber, No. 5 bis. That additional No. 5 was awarded posthumously, for Ferber, flying under the name of de la Rue because he was a serving officer, was killed in 1909 while giving a demonstration.

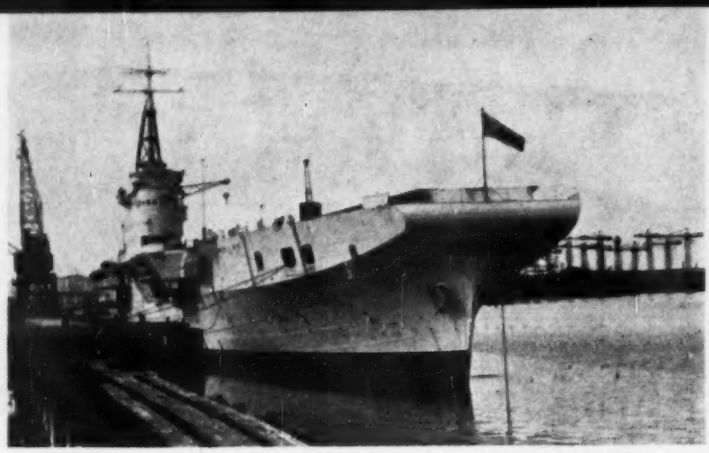
Maurice Farman had No. 6; Jean Gobron, No. 7; Comte de Lambert, a pupil of the Wrights, No. 8; Hubert Latham, who failed because of engine failure to cross the Channel a week before Blériot succeeded, was No. 9; Louis Paulhan, who won the London to Manchester prize, was No. 10; Henri Rougier, a famous Voisin pilot, was No. 11; Santos Dumont, No. 12; Paul Tissandier was given No. 10 bis so as to avoid having the "unlucky" 13, though the Hon. Alan Boyle (who survived till 1949) held No. 13 of the Aero Club of the U.K.; he was very proud of it, and not at all superstitious. Orville Wright had No. 14 and Wilbur No. 15.

Every one of these 15 were true pioneers of flight and their names are thus enshrined in the roll of fame, though not in the correct order of precedence.

G.D.

SERVICE AVIATION

Royal Air Force and Naval Aviation News



STEAM LAUNCH from the new catapult, as seen here installed in H.M.S. "Perseus," may become standard procedure aboard British, Commonwealth, and American carriers if tests now imminent are successful. An account is given below.

NEW YEAR HONOURS

THE names of a number of senior officers at the Air Ministry and in the Commands, together with members of the King's Flight, and other personnel, appear in the list of New Year Honours published in the *London Gazette* for January 1st, 1952. These are given in part below; the remainder will be published in our next issue.

ORDER OF THE BATH

Knights Commanders.—Air Chief Marshal Sir William Forster Dickson, K.B.E., C.B., D.S.O., A.F.C.; Air Chief Marshal Sir Arthur Penrose Martyn Sanders, K.B.E., C.B.

Companions.—A.V-M. G. R. C. Spencer, C.B.E.; A.V-M. H. G. White, C.B.E., M.I. Mech.E.; Act. A.V-M. L. W. Cannon, C.B.E.; A. Cdre. J. A. Easton, C.B.E.; A. Cdre. H. D. Spreckley, O.B.E.; A. Cdre. S. R. Ubee, A.F.C.; G/C. E. D. MacKinlay Nelson.

ORDER OF THE BRITISH EMPIRE

Knight Grand Cross.—Air Chief Marshal Sir Leslie Norman Hollinghurst, K.C.B., K.B.E., D.F.C.

Knights Commanders.—Air Marshal Alick Charles Stevens, C.B.; Act. Air Marshal Colin Winterbotham Weedon, C.B., C.B.E., M.A., M.I.Mech.E., A.F.R.Ae.S.; A.V-M. V. E. Groom, C.B., C.B.E., D.F.C.

Commanders.—Rev. Canon L. Wright, K.H.C.; A. Cdre. J. C. Neely, M.B., D.M., B.Ch., M.R.C.S., L.R.C.P., D.O.M.S., D.O (Oxon); Act. A. Cdre. C. L. Dann, O.B.E., B.Sc., A.F.R.Ae.S.; G/C. C. Broughton; G/C. J. M. Freeman; G/C. R. L. M. Hall, O.B.E., A.D.C.; G/C. C. E. Morse; Act. G/C. W. E. Coles, D.S.O., D.F.C., A.F.C.; Act. G/C. W. K. Stewart, A.F.C., B.Sc., M.B., Ch.B.

Officers.—G/O. N. Hunter, W.R.A.F.; Wing Commanders R. D. Baughan, K. M. Crick, C. R. J. Hawkins, A.F.C., S. J. Jury, G. J. Rayner, D. C. Torrens, T. P. F. Trudgian, D. H. Burnside, D.S.O., D.F.C., G. Tupholme. Act. Wing Commanders G. P. Howell, A. G. Strutt, J. G. Topham, D.S.O., D.F.C. Squadron Leaders J. H. Chart, P. G. D. Farr, D.F.C., H. G. Messer, J. B. Wales, D.F.C., R.Aux.A.F. Act. Squadron Leaders J. McC. Rollo, R.A.F.V.R., G. H. Williams.

Members.—Act. Wing Commander J. R. Hall, R.A.F.V.R. Squadron Leader B. Morgan. Act. Squadron Leaders F. A. Houghton, W. S. O. Randle, A.F.C., D.F.M. Flight Lieutenants L. G. E. Ambler, J. I. R. Bowring, C. A. Brown, G. W. Cornock, D. S. Fowler, H. Hill, D.F.M., W. A. Jeffery, H. Jones, W. Jopling, B.E.M., S. B. Law, H. P. Williams, D.F.C., D. A. S. Woodbridge. Act. Flight Lieutenants C. B. A. Brown, R.A.F.V.R., H. G. Withey. Flight Officer M. Mowat, W.R.Aux.A.F. Flying Officer R. L. Macklin. Warrant Officers S. R. H. Bailey, J. A. Barnes R. S. Beattie, J. F. L. Callaway, T. C. George, J. E. Haden, C. E. Hoad, E. W. Randall, W. G. Rossiter. Act. Warrant Officer D. A. Gourd.

ROYAL VICTORIAN ORDER (Fifth Class)

Squadron Leader H. A. Nash, A.F.C., Flight Lieutenants W. T. Bussey, B.E.M., S. N. Sloan, D.F.C., C.G.M.

The award of the Royal Victorian Medal (Silver) has been made to F/S. A. W. Cousins.

These awards in the Royal Victorian Order are made in respect of service in the King's Flight.

ROYAL RED CROSS

First Class.—Wing Officer J. K. A. Browne, A.R.R.C., P.M.R.A.F.N.S. *Second Class.*—Flight Officer I. M. Chapman, P.M.R.A.F.N.S.

BAR TO AIR FORCE CROSS

Wing Commander G. G. N. Barrett, A.F.C.

AIR FORCE CROSS

Wing Commanders W. Pitt-Brown, D.F.C., E. N. M. Sparks, D.F.C., J. M. Thompson, D.S.O., D.F.C. Squadron Leaders E. W. Descon, D.S.O., D.F.C., J. A. G. Jackson, D.F.C., J. F. McPhie, P. L. Parrott, D.F.C., R. P. D. Potgieter, C. B. Owen, D.S.O., D.F.C., R. S. Radley, D.F.C., A. W. Southall, D.S.O., D.F.C., H. E. White, D.F.C. Act. Squadron Leaders N. E. Hoad, C. B. Urwin, D.F.C. Flight Lieutenants R. W. Charters, A. Collins, D.F.M., G. D. Cremer, J. G. Croshaw, P. R. Edelston, R.AUx.A.F., S. G. Hewitt, K. Ignatowski, D.F.M., F. E. Lord, R. R. McGowan, L. R. Miedzybrodzki, W. K. Owen, D.F.M., P. Porter, A. F. Shaw, R. C. Shuster, K. L. Tebbutt, D. G. Walker, B. Watford, C. W. Watson. Flying Officers A. W. Peddell, H. A. Ramsey, D.F.C., Master Pilot J. Malenczuk. Master Signaller T. N. Evans. Lieutenant Commander D. G. Parker, D.S.O., D.F.C., R.N. Lieutenant G. B. Newby, R.N. Captain O. J. Waldram, R.A.

BRITAIN'S NEW CATAPULT

VARIOUS speakers on naval flying have hinted at the possibility of using, for the launching of aircraft, the power readily available in a carrier; and to many people it will come as no surprise to learn that "steam-operated equipment designed to keep abreast of demands made by the rapid advance of jet propulsion and the tendency towards bigger and heavier aircraft" was built in the light fleet carrier H.M.S. *Perseus* (Capt. R. G. Poole, R.N.) during 1949. The catapult is being developed by the Admiralty and will be demonstrated in America during this year. Trials in Home Waters during the past fourteen months have been highly satisfactory.

To continue trials with the co-operation of the U.S. Navy and to enable American experts to assess the potentialities of the new catapult, H.M.S. *Perseus* was due to sail from the United Kingdom last Monday. She will go to Philadelphia and Norfolk (Virginia) and during a six-week visit will launch U.S. aircraft of different weights and performances from the machines tested. If these further trials are satisfactory the new apparatus will be installed for operational use in carriers for the Royal Navy and the Royal Australian and Canadian Navies.

The catapult uses the principle of the slotted cylinder and has no rams or hydraulic purchases. The hook to which the aircraft is connected is directly attached to a piston, driven along the cylinder by high-pressure steam from the ship's main boilers. A novel sealing device is used to keep the slotted cylinder steam-tight. The inventor is an R.N.V.R. officer, Cdr. (E) C. C. Mitchell, O.B.E., of Brown Brothers and Co., Ltd., Edinburgh, who have designed and built the installation in H.M.S. *Perseus*. The amount of steam required for sustained operation is considerable, but preliminary trials show that the demand put upon the main boilers can be met without interfering with the satisfactory operation of the ship.

Development involved the building of a raised section on the flight deck of H.M.S. *Perseus*, forward of the "island," and the installation of compressors and certain machinery in the hangar. If built into a carrier for operational use it would not call for alteration of the level of the flight deck or interfere with the normal working of the ship below deck. It would be disposed about the vessel, taking up less living and working space than do the most powerful conventional types. The equipment may be expected to ease some of the problems of naval architects and may be expected to affect naval/air tactics by reducing the necessity for a carrier to steam for lengthy periods into the wind. In certain conditions it will enable aircraft to be launched while the ship is stationary.

Development was sufficiently advanced for trials to be started in 1950. At first, dead loads of varying weights and construction were used. Some were sinkable, others were floating types recoverable by surface craft and named for identification *Ida* and *Ivan*, *Noah* and *Nellie*, *Walter* and *Wendy*. Later, unpiloted aircraft were successfully shot off with wing-tips removed and with controls locked. One caused surprise and concern by flying for four minutes round the ship and reaching a height of 1,500ft. Its gyrations were

ended only by its limited fuel supply.

The first piloted aircraft—a Firefly—was flown off in July this year by Lt. Cdr. J. M. Glaser, D.S.C., R.N., the commanding officer of 703 Services Trials Squadron, based at the R.N.A.S., Ford, Sussex. Later he was catapulted successfully in an Attacker. Other pilots of the same squadron, including two Americans, Lt. J. F. Tuttle, U.S.N., and Lt. G. Goudie, U.S.N., took part. Two other members of the squadron, Lt. S. A. Mearns, D.S.C., R.N., and Lt. D. N. Duncan, R.N., are going to America with H.M.S. *Perseus*.

To date, 127 piloted aircraft have been successfully launched. Types of aircraft used include the Sea Vampire, Sea Hornet, Sea Fury, Avenger and Sturgeon, the last-named being the heaviest. In addition, about 1,000 dead weights and pilotless aircraft have been launched.

The experience of the pilots on being launched at a speed far greater than is possible with any other catapult is expressed by Lt. Cdr. Glaser, who reports that the catapult has much greater, but smoother, acceleration than any conventional type, giving a higher flying speed off the deck. The inventor, who has been catapulted as a passenger, says, "Although acceleration is higher, the build-up is steadier and I found it more tolerable physiologically."

The effectiveness of the machinery is emphasized by successful launchings of Fireflies and Sea Furies while the ship has been secured alongside at Rosyth, where she has been based during the trials, and while alongside Airport Wharf, Belfast, during a recent visit. Several launches have been witnessed by visiting senior officers, including the Fifth Sea Lord (Vice-Admiral E. W. Anstice, C.B.) and the Engineer-in-Chief of the Navy (Vice-Admiral (E) The Hon. Denis C. Maxwell, C.B., C.B.E.).

The Admiralty recalls that ever since the first experimental work on an aircraft catapult was begun at the Naval Aircraft Establishment on the Isle of Grain towards the end of the 1914-18 war (with a railway truck used as a launching carriage) research has gone on unceasingly for fundamental developments to give increased performance without a proportionately greater mass of mechanism. No matter what form of propellant has been used, previous catapults have been of the cylinder, ram, pulley and wire-purchase type. One exception is the rocket catapult mounted in merchant ships during the war, which shot off Hurricanes, the pilots of which, after a sortie, either landed at the nearest airfield or carrier, or ditched alongside the parent ship.

As the need for higher performance catapults became more acute, it became evident that the performance of the conventional hydro-pneumatic wire-purchase type had reached its practical limit, unless its machinery was to become so large that it would be difficult to fit into a ship.

DUAL AWARD: Mr. R. G. Menzies pins wings on Cdt. W/O. D. Robertson at the passing-out parade of No. 1 Entry, R.A.A.F. College, Point Cook, Australia. Cdt. W/O. Robertson won both the Sword of Honour and the King's Medal. Behind the Prime Minister is G/C. M. O. Watson, Commandant of the College.

Fighter Command S.A.S.O.

THE appointment is announced of A. Cdre. H. P. Fraser, C.B.E., A.F.C., as Senior Air Staff Officer at Fighter Command H.Q. He will assume the acting rank of Air Vice-Marshal and take up his new appointment from January 9th. He is to occupy the post in succession to A. V-M. D. F. W. Atcherley.

A. Cdre. Fraser has just finished the 1951 course at the Imperial Defence College. His appointment to Fighter Command comes as a surprise as a previous announcement stated that he would become Director of Operations (1) at the Air Ministry.

Services Squash

THE Navy retained their Inter-Services Squash title this year by beating the Army by three matches to two, and the R.A.F. by four to one. The R.A.F. also lost to the Army by four matches to one, and the final points result was thus, Navy 7, Army 6, R.A.F. 2.

Cdr. A. A. T. Seymour-Haydon, Navy champion, won both his matches, and G/C. B. K. Burnett, who retained his R.A.F. championship again this year, beat 2nd-Lt. I. C. de Sales la Terriere. Cpl. A. E. Catherine beat Constr.-Lt. A. E. Griffiths, Navy. The other members of the R.A.F. team were W/C. A. K. Collins, F/L. A. M. Skene, P/O A. A. Ramus.

SERVICES versus SPRINGBOKS

AN unexpectedly large crowd trekked to Twickenham on Boxing Day to see a Combined Services XV do battle with a team of Springboks. They were rewarded by a fine open game in bright, though slippery, conditions, and the resulting win for the South Africans did not appear to be the walk-over that the 24 points to 8 might suggest. Admittedly, the result was never in real doubt. For the Springboks Du Toit and Fry alone represented the team which just beat Wales, but the reserves—if they may be so called—displayed the same remarkable resourcefulness and team combination which has characterized South African play in every game seen in this country.

The Services side comprised six Army players, including the well-known international halves, Hardy and Shuttleworth, and three outsides; the Navy provided three stalwart forwards, including Lt. Cdr. (E) Sindery, the captain; and the Royal Air Force was represented by full-back Smailes and two forwards. Completing the team was Surgeon-Lt. Gray of the R.N.V.R. Private Broome, the Army centre, has been a Rugby League international.

The great difference between the sides was that while one played as an inspired and determined team the other, for most of the time, comprised individuals who occasionally rose and shone. The Springboks opened the scoring early when, following a well-placed kick ahead towards the wing, Marais touched down. Later in the game he repeated this performance to score his third try. Although the Services—particularly their forwards—were now doing better, the half-time score was 11—nil (one goal, one drop goal, and one try).

In the second half the Services continued to improve, and after some ten minutes a fine straight run by Broome, who beat his own man and two others, brought the crowd cheering to their feet; but no score resulted, for as in the case of several other individual efforts the man found himself practically unsupported when the time came to pass. By contrast, every breakthrough by a Springbok found several other men up and ready to take over.

After some 25 minutes in the second half, Shuttleworth cut through near his own twenty-five and there followed the most exciting movement of the day with hard running and passes to Gilbert-Smith, then to Hardy, to Broome, and finally to Gray on the wing, who dived over at the corner for a try which Smailes converted.

The Services' second try came from one of several forward movements up the field; a kick up the left wing followed on an opening rush by Vaughan and others and Scott on the left wing continued the good work and just made the touch-down.

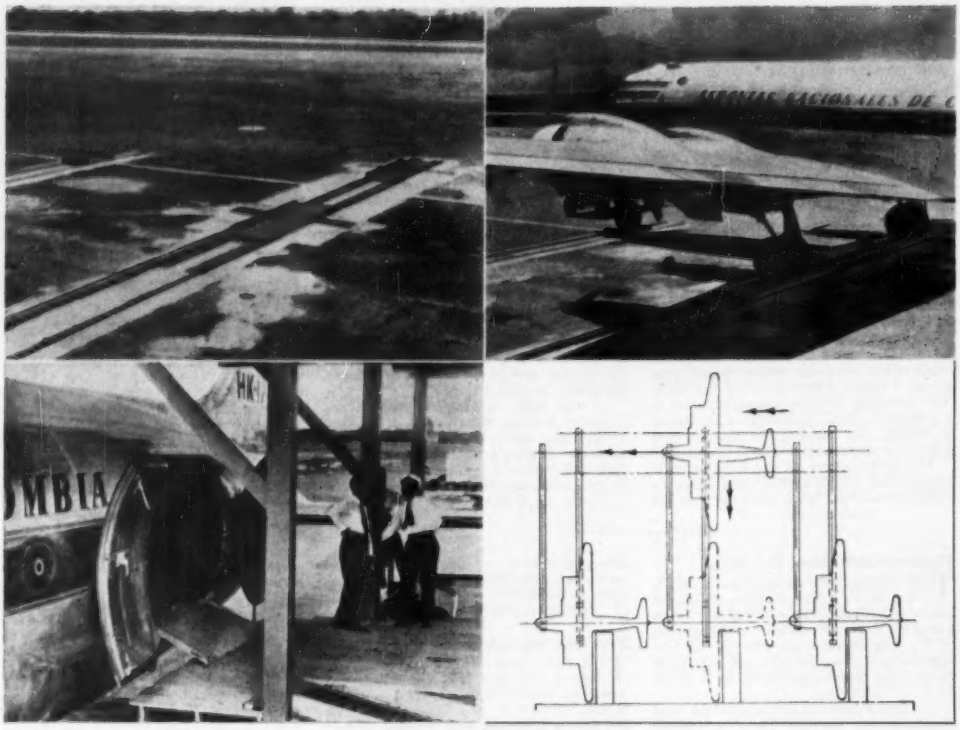
In the meantime, the South Africans continued to score in a regular and convincing manner.

Of other impressions gained in the course of the game we may record that Smailes' fielding was almost up to the best form he has shown in past seasons, and his long touch-finding earned frequent applause. Broome gave every reason to suppose that he will play an important part in the inter-Services Championships on March 1st (*versus* the Navy) and March 22nd (*versus* the R.A.F.). At one time or another most of the forwards could be picked out for good work; both the Williams (Stoker and Flying Officer) were in the front of several good rushes, Instr.-Lt. Vaughan could be depended upon to be there for defence or attack, while it may be said that F/L. Stirling's name sounds most appropriate to the work he does in the scrums.

Combined Services.—*Full back:* F/L. A. A. Smailes (R.A.F.); *Threequarters:* Sgt. D. M. Scott* (Army), Off.Cdt. A. B. Edwards (Army), Pte. J. Broome (Army), Surg. Lt. (D) B. M. Gray (R.N.V.R.); *Half-backs:* Lt. E. M. P. Hardy* (Army), Lt. D. W. Shuttleworth* (Army); *Forwards:* F/L. R. V. Stirling* (R.A.F.), Instr. Lt. R. J. Carter (R.N.), Stoker W. O. Williams* (R.N.), F/O. R. H. Williams (R.A.F.), Lt. D. T. Wilkins* (R.N.), 2nd Lt. D. S. Gilbert-Smith (Army), Instr. Lt. D. B. Vaughan* (R.N.), Lt. Cdr. (E) P. B. Sindery (captain) (R.N.).

* International.

Loading Made Easier



(Upper left) The "dollies" of the Loadair system described below are seen in position to receive the wheels of the aircraft. (Upper right) The machine is winched sideways until its doors are flush with the loading dock, as seen at lower left. (Lower right) Working on this plan the Loadair system makes possible a saving of 50 per cent in ramp handling-time.

THE idea of winching aircraft up to a dock for loading purposes is by no means new, but although investigations of this principle have been going on for nearly ten years it was only recently that the first practical application was successfully demonstrated. A device, known as the Loadair system, developed by the Whiting Corporation, was placed in experimental operation about three months ago by the Colombian airline, Avianca, one of the world's biggest freight-carriers. In its brief experience with the Loadair this company is said to have found that it can reduce ramp handling-times by about 50 per cent.

Representatives of major airlines, aircraft manufacturers and airports who have visited Soledad Airport, Barranquilla—where the device is installed—have all, according to reports, been impressed by its efficiency.

Briefly, the system involves the use of a number of skids running on rails set into the taxi-way. The pilot taxies on to these "dollies" as they are called, from a straight approach. When his wheels have rolled on to the dollies, which are only 1¼in higher than the tarmac, they contact mechanically operated chocks, which index the aircraft directionally and can be elevated as soon as it is in position. The chocks, incidentally, are designed to collapse if excessive loads are induced by fast taxi-ing.

By means of push-button control from a central panel the aircraft is then winched sideways to the dock, the hauling mechanism being simply a standard crane-hoist or railway-truck winch.

An extensive "door-location" study was necessary in order to solve the major problem of relating the height of the dock to that of various aircraft layouts. It was found, however, that in practice there is a remarkable uniformity in the position of the main-cabin doors in all transport aircraft. Compensation systems have, nevertheless, been incorporated in the Loadair to take care of any variations which may be encountered as far as door and aircraft nosewheel locations are concerned.

Among the more obvious benefits of the system are the opportunity to protect passengers and cargo from the weather by roofed docks leading right up to the aircraft entrance door, the elimination of mobile ramp-equipment and the substitution of fixed facilities for refuelling and servicing the aircraft. Some other advantages, which may not be so readily apparent, are reflected in such items as cost-savings from reduced paving-area requirements—for the Loadair can park three aircraft where only two can be accommodated with conventional methods. It has been estimated also, that from the airline viewpoint considerable savings may be achieved through faster and more efficient loading and servicing of machines. In addition, there is less risk of aircraft (particularly the jet-powered variety) being damaged through having to manoeuvre in confined spaces.

M.C.A. NEWS-HANDLING

EXACTLY five years ago the Ministry of Civil Aviation Information Division was set up under the leadership of Mr. Vincent Alford, M.A. (previously with the B.B.C. Educational Unit). Having served its purpose admirably during the difficult post-war development period, the department starts the New Year with a much-reduced staff. The decision to cut back in this manner was made by Lord Ogmore before the change of Government and, while it may be regretted in some places, the overriding need to make economies in the Ministry provides the main justification. It is also true that the need for a staff of information officers is no longer so great as it was when the Corporations were feeling their way, when much new legislation was being put into force for the first time, and when new civil aircraft were being purchased abroad.

In the new streamlined organization Mr. Alford, chief information officer, is assisted by one press officer at London headquarters, another press and P.R. officer at London Airport, and a Scottish divisional P.R.O.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Those Phonetics

I THINK your correspondent "Flip" (*Flight*, December 21st), on "Phrenetic Phonetics," produced a very good ode to Able Baker Charlie, but I would point out a slight error in Verse 6, in order that "Flip" may "Roger" if he wishes.

The new phonetics are intended to replace the old Able Baker Charlie and to be used for proper names, Service abbreviations, and words of which spelling is doubtful. In fact, it is a "word-spelling alphabet."

May I therefore suggest to "Flip" the following slight alteration to his Verse 6:—

Maybe I'll never sing again
Or croon a vo-de-do,
Except for Roger occasionally
But lots of Papa Quebec Romeo.

Prestwick, Ayrshire. H. GILBERT.

(A letter addressed to "Flight's" Gemini, G-AFLT)

DEAR Golf Alfa Foxtrot Lima Tango,—Reading through the new phonetic Alpha Bravo Coca, I find it difficult to believe that I am not having my Lima Echo Golf pulled. Frankly, I think this is the very Echo Nectar Delta.

Trying to take the thing seriously, however, I cannot help wondering whether it was just dimness that led to the selection of "Hotel" for "H" in an international code. Surely only about two nations soun I the "h" in hotel, and the people of *those* two are not very sure about it.

It is to be hoped that a guide to pronunciation will be provided, for I am sure I don't know whether to say "Extrah" or "Extray" for "X." Again, do "K" and "L" stand for Keelo and Leemah or Killo and Lymer? Even "P" can stand for Papah or Pappa. (What's the betting it will finish up as Pop?) And what *is* Coca anyway?

By the way, when a lad is old enough to learn his three new Rs, he should be appropriately equipped to take his place in this modern society. SIERRA METRO INDIA TANGO HOTEL.

London, Nectar Whisky.

[There is guidance on the pronunciation of some of the words. Kilo is Kee-lo, Metro can be called May-tro if desired, the syllables of Papa have equal emphasis, Quebec is Kibbeck, Sierra is See-erra, and Union can be Oonion. Coca, says our dictionary, is a South American plant "the dried leaves of which are used as a powerful nerve stimulant, and yield cocaine"; this seems appropriate.—ED.]

Other Side of the A.T.C. Picture

THE note concerning the A.T.C., by "Aristarch," in your issue of December 14th, makes it appear that there exists in the movement a certain amount of dissatisfaction. To a certain degree this is true, especially regarding the shortage of certain types of equipment—for example, radio; but at the same time it must be remembered that dissatisfaction is in no way caused by the R.A.F. and that all the hard work and services tendered by them solely for our benefit and interest are appreciated.

Of these services, flying and the annual camp are, perhaps, the most eagerly and enthusiastically awaited by the squadron which I attend, and I would like to take the opportunity to express our thanks to all the officers and other ranks who, each week-end, voluntarily give up their time in all kinds of weather to enable cadets to obtain flying experience.

In conclusion, it must not be thought, as "Aristarch" imagines, that A.T.C. squadron headquarters are the scene of constant grousing—we are only too grateful to those people, both inside the R.A.F. and out, who spend so much time in attempting to satisfy our requirements.

Sheffield 5. P. BOWEN,
Sgt., 370 Firth Park (Sheffield) Squadron, A.T.C.

IN your issue of December 14th, "Aristarch" pleads plaintively for more radio equipment for A.T.C. squadrons, and suggests that through lack of it and of imagination at "policy levels," interest in the A.T.C. is waning.

I would suggest that any waning interest results from a lack of imagination, drive and leadership at "squadron level," particularly in implementing the new training syllabus in an attractive way!

It would, in my opinion, be a great mistake if the Air Ministry spoon-fed A.T.C. squadron commanders with all the bits and pieces required for training; rather, the initiative of the A.T.C. should be stimulated by the necessity to "acquire" what they want from various sources. "On the air" radio transmitting may have a certain publicity value, but the prestige and strength of the corps can far better be furthered by building up a healthy respect for the squadrons by results, and this can only be done by setting a high standard of entry, discipline, attendance and turn-out, and by taking part in every activity, aeronautical or athletic, that presents itself.

By such means, in twelve months it has been possible to raise the strength of this squadron by 50 per cent, and at the same time to win the Squadron Efficiency Trophy. Little radio instruction has been possible during this period through lack of instructors, but we have more than compensated for this deficiency by promoting airmindedness in general, through the display of posters, air diagrams and demonstration equipment, most of which has been "acquired," and through which we have produced a high number of "regulars" for the Royal Air Force.

We are marooned on an island, with no R.A.F. station at hand to help us, but we have "pressed on regardless."

Ryde, I.O.W. R. B. STRATTON, F/L., R.A.F.V.R.
O.C. No. 1024 (East Wight) Sqn., A.T.C.

Vintage Aircraft—Help Wanted

AS the owner of a vintage aircraft, a D.H.53 or Humming Bird, I am wondering if any of your readers can advise me as regards obtaining spares. There were four of these aircraft in existence at the beginning of the war, and one of them crashed at Boston in 1940. I believe mine is now the only one left, and I would like to get it serviceable again. It was flying up to 1939 and was then stored during the war years, when certain control surfaces, etc., were stolen.

I have overhauled the airframe and engine, and the mainplanes are now ready for re-covering. The overhaul up to now has included building a new centre-section, windscreen and instrument panel, and fitting instruments. I have also renewed the wing main-ribs and nose-ribs.

The parts I have been unable to obtain are the vee-struts for the mainplanes, a fin and rudder, and tailplane and elevators, also an airscrew suitable for an A.B.C. Scorpion engine. The port aileron is also missing, but a starboard aileron would help a lot, as the ribs would come in handy for building one up. De Havillands cannot help me, due to the rearmament programme.

Any structural details of the missing parts, such as ribs and spar sizes, would also be of great assistance. I am an ex-airframe and engine fitter.

Sandwich, Kent. J. BROWN.

[The D.H.53 was a low-wing single-seater; several were built round about 1925. Perhaps members of the recently formed Vintage Aeroplane Club would be able to help this enthusiast, whose address is: Coldred Cottage, Lower Street, Eastry, nr. Sandwich, Kent.—ED.]

FORTHCOMING EVENTS

Jan. 11. A. and A.E.E., Boscombe Down: Contractors' Dinner.
Jan. 18. Helicopter Association: "A Review of Helicopter Patents," by Lt. Cdr. P. G. Satow, D.S.C., R.N.
Jan. 18. Institute of Navigation: "Navigational Errors," by W/C. E. W. Anderson, O.B.E., D.F.C., A.F.C.
Jan. 19. Aircraft Recognition Society: Hurricane Trophy Competition.
Jan. 19-20. Vintage Aeroplane Club: Rally.
Jan 28-Feb. 1. Institute of the Aeronautical Sciences: 20th Annual Meeting, New York.
Jan. 29. Society of Instrument Technology: "Mechanical Consideration in the Design of Servo Systems," by Prof. A. Tustin.
Feb. 11. Institute of Transport: Brancker Memorial Lecture. "The Flying-boat and its place in Aviation," by Air Chief Marshall Sir Frederick Bowhill, G.B.E., K.C.B., C.M.G., D.S.O.
Feb. 15. Institute of Navigation: "Navigation Aids for Military Aircraft," by S/L. D. Bower.
Feb. 20. British Institution of Radio Engineers: "Search Radar for Aircraft," by P. L. Stride.
Feb. 22. Helicopter Association: "Helicopter Power Plants," by A. Graham Forsyth, B.Sc., F.R.Ae.S.
Feb. 23. Society of Licensed Aircraft Engineers: Main Lecture: "Some of the Responsibilities and Problems of an Airworthiness Authority," by R. E. Hardingham, O.B.E., F.R.Ae.S., M.S.L.A.E.
Mar. 21. Helicopter Association: "Recent Helicopter Research Investigations," by W. Stewart, B.Sc.

The Industry

Hawker Siddeley Results

TRADING results of the Hawker Siddeley Group for the year ended July 31st, announced shortly before the Christmas holiday, showed that the previous year's downward trend in profits had been reversed. It is stated that the improvement is due to expansion in turnover, both in quantity and value.

Net profits of the Group, subject to taxation, were £5,224,595 as against £3,927,970 for the previous year.

The accounts disclose that considerable sums have been set aside to various reserves. Commenting on this, the Group says that its Board feels that "full recognition should be given to the fact that present-day trading is considerably influenced by inflation and high taxation. Traditional methods of computing profits take account of historical costs only, whereas industry is faced with the economic reality of having to replace assets, consumed in earning profits, at progressively increasing prices. It is the Board's belief that the existing taxation code makes inadequate allowances for depreciation and replacement of capital assets and insufficient margin is left for replacement and, indeed, expansion of trading stocks. Reserves have been increased with these factors in mind, so that the Group may insure itself against future inflationary tendencies."

APPOINTED TO HAWKER BOARD: Mr. J. T. Lidbury, who has been appointed a director of Hawker Aircraft, Ltd., and of Hawker Aircraft (Blackpool), Ltd. He has been secretary of the former company since 1948 (he joined it in 1940) and of the latter since its formation earlier this year. The Blackpool branch of the organization will operate at Squires Gate and use the airfield there.

Industrial Lighting Plant

FROM the firm of A. C. Morrison (Engineers), Ltd., Rectory Place, Loughborough, come details of an addition to their range of industrial and domestic electric power and lighting plants. It is a 2.5 kW unit powered by an air-cooled Petter diesel engine developing 4.5 b.h.p. at 1,500 r.p.m.

There are four alternative control systems, the most popular being a fully automatic type which offers facilities equivalent to those of mains supply in that the generating plant begins operation when any light or power switch is depressed, and ceases to function when the last lamp or other electrical appliance on the premises is switched off. The alternatives are: remote control situated at any convenient location, press button on the control panel, and hand starting of the plant.

The current is supplied at standard mains A.C. voltage so that premises already electrically wired for mains supply will find such wiring suitable for the Morrison set.

Alvis Achievement

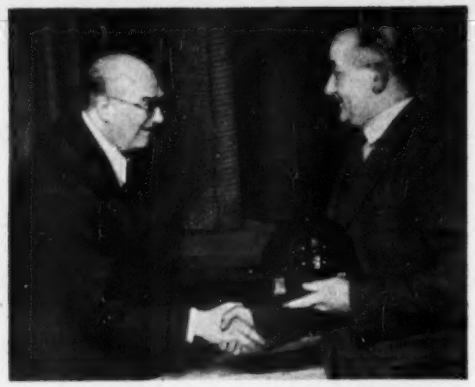
IN a statement circulated to stockholders in connection with the annual general meeting of Alvis, Ltd., held in Coventry on December 19th, Mr. J. J. Parkes (chairman and managing director) said that the Leonides engine had continued to strengthen its unique position as the only modern 550 h.p. type which had gone into production since the war ended. It was particularly gratifying to mention that it formed the power unit of the Percival Provost single-engined basic trainer which had been selected for re-equipment of the Royal Air Force. In addition, that Service had now decided to adopt a modified version of the Percival Prince, as a twin-engined type for various duties, in which rôle it would be known as the Pembroke.

These installations were additional to those previously announced, which included the Percival Sea Prince, the Prestwick Pioneer, and three types of helicopter.

Leonides engines were now operating in Great Britain and Europe, North and South America, Africa, the Middle East, the Far East, and Australia.

The company's efforts to establish a position in the aircraft-engine industry, said Mr. Parkes, had been long and arduous, but he thought it could be said that a useful portion of the available business had now been secured.

At the meeting, accounts providing for the payment of an Ordinary dividend of 6 per cent less tax, were adopted.



MR. ROBERT BLACKBURN, chairman of Blackburn and General Aircraft, recently presented mementoes—clocks or silver cigarette-cases—to 41 members of the staff who had attained 21 years' service (there are now 257 such employees). Among recipients on this occasion were Mr. W. A. Hargreaves, works director; Mr. C. P. Truyens, design superintendent; Mr. J. T. Ormerod, jig-and-tool designer; Miss A. E. Wood, packing department; and—seen above—Mr. C. E. Tiplady, experimental department. Incidentally, this was the 21st anniversary of the presentation of a memento to Mr. Blackburn himself, for it is now 42 years since he flew his first aircraft.

New Dowty Components

AT the fifteenth annual general meeting of Dowty Equipment, Ltd., held at Cheltenham on December 18th, shareholders learned from the statement of the chairman (Mr. G. H. Dowty, F.R.Ae.S.) that profits had reached a record level, largely due to the contributions of the associated companies.

Over 13 per cent of the sales of the parent company were to countries abroad, and well over a quarter of these to North America. New components were in production. The "Vardel" variable-delivery pump would replace the well known "Live Line" pump, and the "Hydel" lightweight solenoid control valves was scheduled for use on a large variety of aircraft types.

Extracts from Mr. Dowty's statement read:— "Turbo Fuel Systems, Ltd.—This year has seen a marked growth in our business of fuel pump and burner systems for gas turbines. Our fuel supply equipment is now standard on several engines, both in this country and abroad.

"Dowty Equipment of Canada, Ltd.—During the year I visited our Canadian Plant and was impressed with its growth. In addition to its regular production, the company has built up a large repair organization for the overhaul of landing-gear, hydraulic equipment, and Dunlop wheels and brakes.

"Coventry Precision Ltd., was purchased in May of this year and its aircraft activity will be mainly the manufacture of fuel pumps and fuel systems.

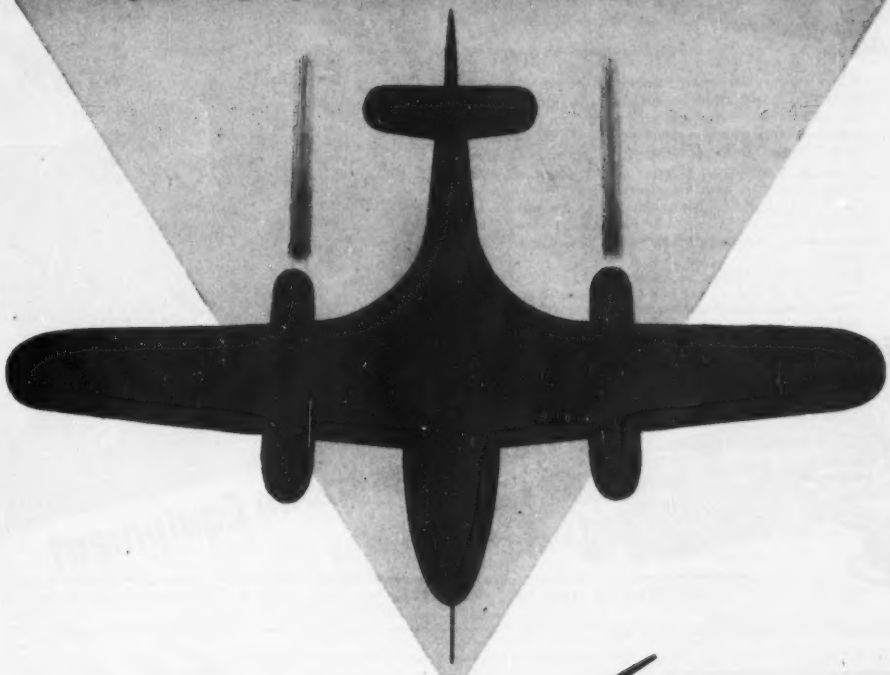
"New Mendip Engineering Co., Ltd.—Our Wiltshire works has increased its capacity by the addition of further plant.

"Dowty Auto Units, Ltd.—During the last 12 months orders for mining and industrial hydraulic equipment have substantially increased.

"Dowty Seals, Ltd., has a record order book; the number of customers has greatly increased."

GOING AND COMING: Mr. George H. Miles, M.S.A.E. (left), who has been chief designer at the Airspeed works at Christchurch since 1949, has now left there to renew his business association with his brother, Mr. F. G. Miles. He is succeeded by Mr. W. A. Tamblin, A.F.R.Ae.S., A.M.I.N.A. (right), one of the most senior of the D.H. designers from Hatfield, who will henceforth be in charge of the Airspeed Division's design and experimental departments. Mr. Tamblin, who has been with de Havillands since 1935, has had a major share in Comet design.

Everything points to a CELLON finish



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21. Fairey Tipsy.
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26. Lockheed 14P.
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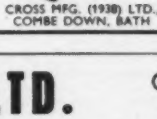

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JIG and tool draughtsmen required, fully experienced.—Applications, in writing, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds., stating age, experience and salary required. [7493]

APPLICATIONS are invited from design draughtsmen and stressmen; also from technical assistants with combined design and performance experience for work on both reciprocating and gas turbine aero engines.
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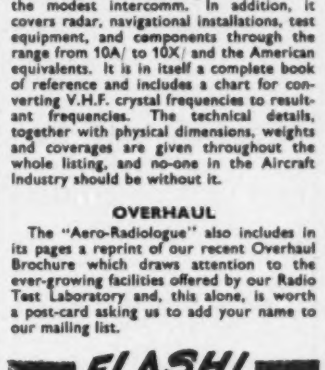

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ASSISTANT technical costs officers required by Ministry of Supply for London. Qualifications: British, of British parentage; regular engineering apprenticeship. Good experience of rate-fixing, planning and prime cost estimating in works manufacturing high class engineering products; possession of O.N.C. (Engineering), or equivalent, an advantage. Experience of fire control aircraft, aero engines, or radio/radar production additional advantage. Duties include preparing detailed estimates of prime cost manufacture of engineering products for Government contracts. Successful candidates must be prepared to travel. (Candidates selected for interview may be required to carry out blue-print test of ability to perform these duties.) Salary: £570 (limited to age 30) to £675 p.a. Women slightly lower. Not established. Opportunities for established pensionable posts may arise.—Written applications, giving date of birth and education, full details of qualifications and experience of posts held (including dates), should be addressed to Appointments Officer, Ministry of Labour and National Service, 1-6 Tavistock Square, W.C.1, quoting reference number K.F.428, within 14 days of appearance of this advertisement. In no circumstances should original testimonials be forwarded. Only candidates selected for interview will be advised. [7479

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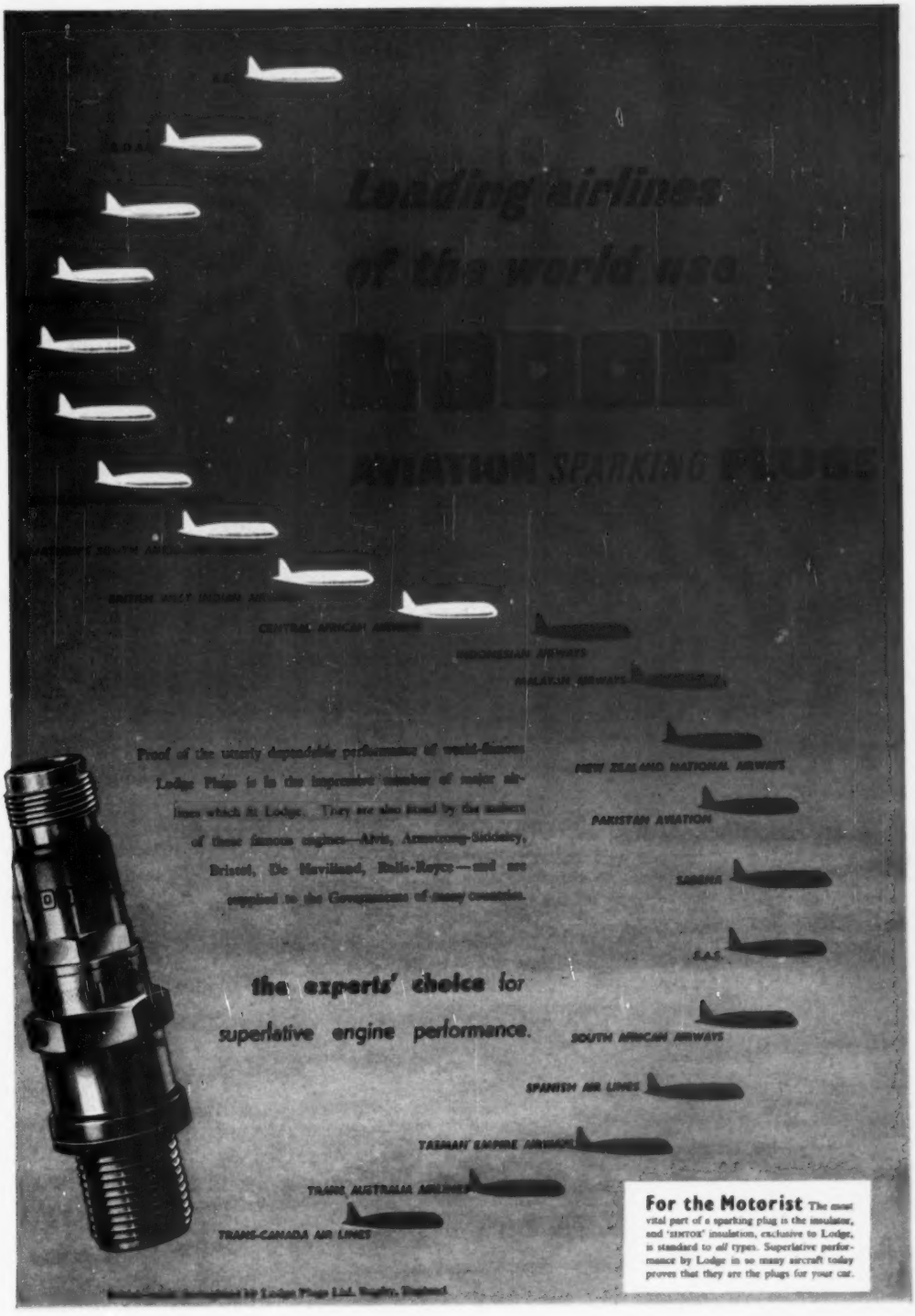
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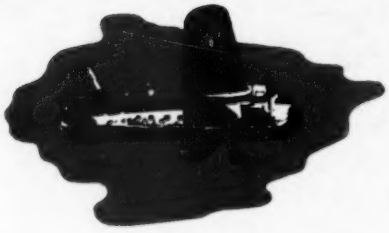
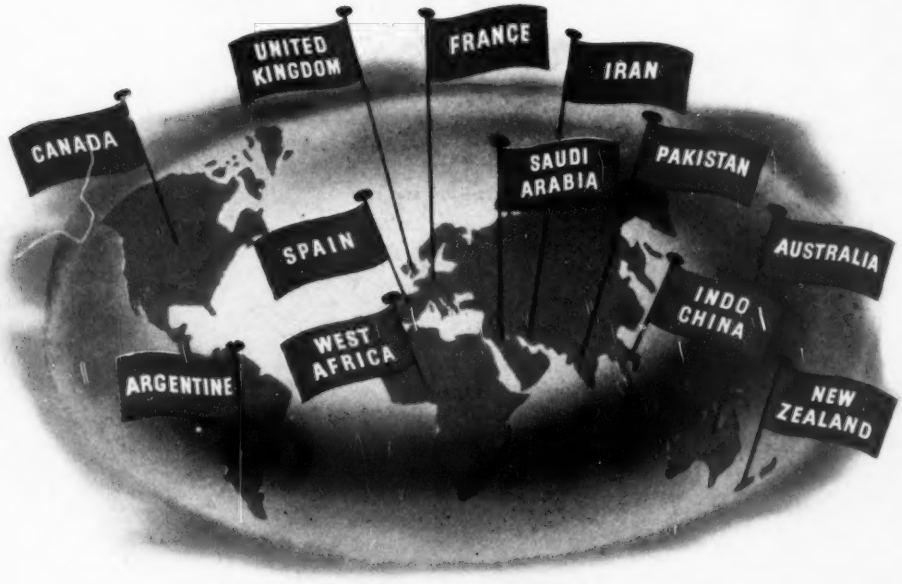
the experts' choice for superlative engine performance.
For the Motorist The most vital part of a sparking plug is the insulator, and 'SINTOX' insulation, exclusive to Lodge, is standard to all types. Superlative performance by Lodge in so many aircraft today proves that they are the plugs for your car.



. . . on which the sun never sets

The versatile "Bristol" Type 170 Freighter is to-day in regular service with Commonwealth air forces, scheduled air-lines and charter companies in a dozen different countries in all parts of the world. From Canada and the Argentine in the west to Australia and New Zealand in the east, Freighters are engaged on an unceasing round of operations on which the sun never sets.



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